Longacre

DEFORMITIES OF THE MOUTH.

THIRD EDITION.

DEFORMITIES OF THE MOUTH,

CONGENITAL AND ACQUIRED,

WITH

THEIR MECHANICAL TREATMENT.

BY

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THIRD EDITION.

With Eighty-three Wood Engravings and Ninety-six Drawings on Stone.

PHILADELPHIA:

PRESLEY BLAKISTON.

1881.

THE FIRST AND SECOND EDITIONS

OF THIS WORK

WERE DEDICATED TO

SIR WILLIAM FERGUSSON, BART., F.R.S.,

SERGEANT-SURGEON TO THE QUEEN;

THE PRESENT EDITION IS DEDICATED TO HIS MEMORY

BY HIS

FORMER PUPIL.

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PREFACE TO THE THIRD EDITION.

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The present Edition has been carefully revised, a considerable portion entirely re-written, three new chapters added, the number of wood-cuts increased from fifty-one to eighty-three, and the drawings on stone from nineteen to ninety-six. It will, thus, I hope be recognised that I have endeavoured to make the present volume worthy of the same measure of esteem that has been awarded to the previous issues.

18, Wimpole Street,
March 30th, 1881.

PREFACE TO THE SECOND EDITION.

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The favourable reception of the first Edition of this work by the Medical Press and Profession, both in England and America, has shown that it was not altogether an unnecessary contribution to Dental literature.

The alterations and additions I have now made will, I trust, render it not less worthy of the considerate notice with which it has been already received.

I cannot but express my deep obligations to my friends, Dr. Morell-Mackenzie and Mr. Christopher Heath, for their great kindness in placing cases and preparations at my disposal, during the progress of this second Edition through the press.

In the former Edition of this Work I enjoyed the co-operation of Mr. Robert Ramsay, but being no longer connected with that gentleman, I am alone responsible for the present volume.

Wimpole Street, Cavendish Square, W.
May, 1870.

PREFACE TO THE FIRST EDITION.

In bringing this volume before the members of the Dental and Medical profession, I desire to state my reasons for thinking that such a work would not be unacceptable. For some few years past the treatment of Congenital Cleft Palate has formed a subject of considerable discussion before both Medical and Dental societies; and our journals have always been ready to receive communications on a matter that seemed to command so much attention.

The recent advances that have been made in the mechanical treatment of this deformity have not lessened the interest that had already arisen; and as no publication of the mode of procedure and account of cases had appeared since the time of Snell, in 1828,—apart from reprints of papers read before the learned societies,—I was induced to think that the present book, though by no means so complete as the subject deserves, would be of interest to those gentlemen who have devoted time and attention to this speciality, as well as to the general practitioner.

Where I have given descriptions of the *modus operandi* of any part of the treatment put forward, I trust I shall have been found to be sufficiently explicit; and in the chapter on the appliances used in the past, and at the present time by other gentlemen, I hope it will be recognised that I have endeavoured to be impartial.

In reference to the account of cases, treated by

mechanical means, of loss of parts arising from accidental causes, I feel some explanation is necessary. The novelty in these instances does not consist so much in the general line of treatment adopted, as in the fact that where elastic rubber has been used it has been adapted in metallic moulds, made expressly for each case, to the outline of the deficiency which it was intended to supply; the facility with which this can be done being considerably increased since the first manufacture of elastic rubber in this country, about eighteen months since, so pure and so carefully prepared as to be suitable for Dental purposes. Before this date we were dependent on America for our supply.

I have to thank many medical and professional brethren for the cases they have placed in my hands for treatment; but there are obvious reasons for my not mentioning their names in those instances where I have given a report of the treatement pursued.

Wimpole Street, Cavendish Square, W.
October, 1868.

DEFORMITIES OF THE MOUTH.

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CHAPTER I.

THE ANATOMY OF THE NORMAL PALATE.

The palate may be described as a horizontal partition separating the nasal fossæ from the mouth, and forming the roof of the latter cavity. It is constructed partly of hard and partly of soft tissue, the anterior and larger portion consisting of bone and being termed the hard palate, while the hinder portion is made up mainly of muscular fibres and is termed the soft palate, or *velum palati*. Both portions are covered on either surface with mucous membrane and provided with numerous glands.

The hard palate is bounded in front and on both sides by the alveolar arch of the upper jaw; posteriorly it is continuous with the soft palate. It is formed in its anterior three-fourths by the palate plates of the superior maxillæ, the remaining fourth being supplied by the horizontal plates of the palate bones. A small portion of the hard palate at its anterior extremity, corresponding to the incisor segment of the alveolar

arch, is formed originally by the intermaxillary bones, which will be described more fully in a subsequent paragraph; but under normal circumstances these bones coalesce at an early period of fœtal life with the adjacent superior maxillæ, and the only trace of their separate origin met with in the adult skull consists of two sutures, the *incisive sutures*, which diverge from the median suture on either side to join the alveolar arch between the canine and lateral incisor sockets. As a rule, however, even these sutures disappear after puberty. The upper surface of the hard palate forms the floor of the nasal passages; it is divided into two shallow channels by a double median ridge, which receives the inferior border of the vomer and septal cartilage.

The soft palate may be described as a door-like flap, which, when in its usual position, is vertical with a slight curve backwards, but which in the act of deglutition swings upwards so as to become more or less horizontal, its posterior free border meeting the posterior wall of the pharynx and effectually closing all communication between the nasal passages and the alimentary tract. It is limited on either side by the pillars of the fauces, and presents on its anterior surface a median ridge prolonged below into a conical process, the uvula. The muscular fibres, of which the soft palate is almost entirely composed, are derived

from five pairs of muscles. Of these, the *palato-glossi* ascend from the sides of the tongue in the anterior pillars of the fauces, and spreading out in the soft palate unite with each other in the median raphé; the *palato-pharyngei*, starting from the median raphé in exactly the reverse direction, descend in the posterior pillars of the fauces and spread out over the sides of the pharynx; the muscles of the uvula—known as the *azygos uvulæ*—descend into that process from the median raphé and sometimes from the spine of the hard palate; the *levatores palati* pass downwards and forwards from the extremity of the petrous bone to join each other by means of a membranous expansion on the posterior surface of the soft palate; and the *tensores palati* descend from the roots of the internal pterygoid plates of the sphenoid bone, and after being reflected round the hamular processes at the extremities of those plates, spread out and meet each other in the soft palate. The actions of these muscles, which are somewhat complicated, will be considered in a future chapter *(see Chapter IV.)*.

The entire palate, in its usual configuration, is a shallow boat-shaped fossa, concave both from before backwards and from side to side, so as to correspond more or less exactly to the convexities of the tongue. A *vertical* section in the plane of the second bicuspids shows the outline of the hard

palate to be that of a broad and flattened Norman arch, the centre of which supports above the vertical septum of the nose. This septum may in fact be regarded as the key-stone of the palatal arch, the downward pressure of which, communicated from the growing sphenoid, prevents any excessive vaulting of the palate during the rapid growth of the facial bones at the time of the second dentition. The *longitudinal* contour of the palate presents a much shallower concavity than the transverse, especially in its central two-fourths, where it is but little divergent from a straight line. On the other hand, it is considerably arched behind when the soft palate is in its normal position, and there is not unfrequently a very considerable concavity in front, the abruptness of which, however, varies with the depth of the alveolar process of the upper jaw.

The above brief sketch of the anatomy of the normal palate will be quite sufficient for the requirements of the present volume, the reader being referred for any further details that he may require, to the standard text-books; but it will be necessary to enter with a little more fulness into the exact dimensions of the palate, a subject which has hitherto received very little attention.

In view of the general absence of information on this point, I have made careful measure-

ments of a considerable number of skulls, chiefly in the Museum of the College of Surgeons. It will be sufficient for our present purpose to give the general results thus obtained. The dimensions were taken by means of strips of lead, accurately moulded to the contour of the palate in different positions, the results being immediately outlined on cardboard; the measurements were then taken off by means of compasses and a millimeter rule. It will be sufficient here to give three dimensions of the palate, viz., the width, taken from the inner margin of the alveolar process opposite to the second bicuspids; the height, taken from the centre of the line representing the above width to the centre of the palatal arch; and the length, taken horizontally from between the central incisor sockets to a vertical line let fall from the posterior nasal spine. The skulls examined fall into two series: first, thirty four adult skulls of European origin; and secondly, thirty-two adult skulls of mixed races.*

In the first series the average length was 49 millimeters (maximum 58 m., minimum 40 m.); the average width was 35 m. (maximum 42 m., minimum 31 m.); the average height was 9 m. (maximum 15 m., minimum 5.5 m.). In the

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* On the different size of the jaws in civilized and uncivilized races, see Darwin, "Descent of Man," vol. 1, p. 118; Herbert Spencer, "Principles of Biology," vol, 1, p. 445.

second series the average length was 54 m. (maximum 65 m., minimum 43 m.); the average width was 35 m. (maximum 40 m., minimum 29 m.); the average height was 12 m. (maxi- 18 m., minimum 6 m.). The figures will be found to correspond pretty closely with those published by Dr. Claye Shaw,* except in relation to the height of the palate, in which Dr. Shaw's results differ very materially from those which I have obtained. The annexed table will show at a glance the points of agreement and difference between the two series of investigations.

The only way in which I can account for the discrepancy between Dr. Claye Shaw's measurements and my own in regard to the height of the palate is, by the supposition that he has taken his level from the grinding surface of the teeth, whilst my own was taken from the margin of the alveolus.

Before closing the present chapter, it will be well to direct attention more particularly to the intermaxillary bones, which we shall find playing a much more important rôle in the case of malformed palate, than they do under normal conditions. Interesting as these bones are both to the comparative anatomist and the surgeon, it is curious to note how long their very existence in the human subject was discredited, and by what

* "Journal of Mental Science," July, 1876, p. 200.

Measurements of the Normal Palate.

	Average length in millimeters.	Average width in millimeters.	Average height in millimeters.
European skulls (34) (Oakley Coles).	**49** (max. 58, min. 40)	***35** (max. 42, min. 31)	***9** (max. 15, min. 5.5)
Skulls of mixed races (32) (Oakley Coles).	**54.9** (max. 65, min. 43)	***35** (max. 40, min. 29)	***12** (max. 18, min. 6)
Number and origin not stated (Claye Shaw).	**50** (max. 57, min. 40)	At first molars. **36** (max. 44, min. 21) … At first biscuspids. **34** (max. 38, min. 14.5)	At first molars. **14.5** (max. 25, min. 9) At first biscuspids. **14.5** (max. 21, min. 9)

* Taken at second biscuspids.

slow and uncertain steps science arrived at a definite opinion concerning them. There are few chapters in the whole history of scientific discovery more interesting than that which relates to the researches and discussions in connection with this point. Galen, who had assured himself by dissections, of the presence of intermaxillary bones in apes and other animals, boldly inferred their existence in the human subject; but it is practically certain that he never succeeded in verifying the inference.* The vagueness of his expressions on this point did not, however, prevent his ardent admirers in the sixteenth century from heaping abuse on Vesalius, when that great and original genius ventured to express a doubt as to whether Galen had ever really seen intermaxillary bones in the human cadaver;† and Sylvius, the foremost opponent of Vesalius in this discussion, went so far as to affirm‡ that even if men had no intermaxillary bones in the 16th century, they must have had them in Galen's time. In the end, however, the opinion of Vesalius carried the day, and for more than two centuries the absence of intermaxillary bones from the human skull was generally accepted as

* Galen, De usu Partium, Lib. ix. cap. 20, and De Ossium Naturâ, cap. iii. p. 14.

† Vesalius, De Corporis Humani Fabricâ, Basil. 1855, p. 53.

‡ Sylvius, Vesani cujusdam Calumniæ, &c. Paris, 1551, sec. 5.

a proved and certain fact in science, being put forward, indeed, by Camper as the best criterion for distinguishing man from the higher apes. The credit of exposing this fallacy and of showing once for all that there is no such break in the uniformity of nature, as the older anatomists believed, has been divided between Goethe and Vicq-d'Azyr, who seem—independently of each other—to have discovered the existence of inter-maxillary bones in the human fœtus between the years 1779-84. But while fully admitting that it was the writings of these illustrious men which first called the general attention to the subject, and that it was specially—though not exclusively* —Goethe's merit to have shown the importance of the discovery as illustrating the unity of type throughout the animal kingdom, it is but justice to state that the real discovery had been made half a century earlier by one of our own country-men, Dr. Robert Nesbitt, whose modest claim has however, been unfortunately overshadowed by the lustre of his successors. In a lecture delivered before the Royal College of Surgeons in 1736, Dr. Nesbitt not only describes and figures the suture which "is at all times of life visible cross the anterior part of the roof of the mouth;" but

* Vicq-d'Azyr also pointed out the bearing of his discovery on the doctrine of uniformity of type. Cf. Œuvres, iv. p. 159.

states on the succeeding page that, in the fœtus at the fourth month, at this suture "each bone [*i.e.*, each superior maxilla] is generally divided into two distinct parts from between the dentes canini and incisivi up to the bottom of the nose."* There can be no doubt from the above passage that Nesbitt was the first to find indubitable evidence of the existence of intermaxillary bones in man; at the same time it must be admitted that he never really recognized the importance of the discovery, which it was left to Goethe and Vicq-d'Azyr to fully establish.†

In the present century the subject of the intermaxillary bones in man has been very fully studied by G. Fischer,‡ M. J. Weber, F. S. Leuckart,§ and

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* Robert Nesbitt, Human Osteogeny, London, 1736, pp. 90, 91.

† The opposing claims of Goethe and Vicq-d'Azyr have been so fully discussed by the late Mr. G. H. Lewes in his "Life of Goethe," pp. 342 et seq., that it is perhaps scarcely necessary to give the following original references:—

Goethe.—"Dem Menschen wie den Thieren ist ein Zwischenkieferknochen zuzuschreiben," Jena, 1776; cf. also "Zur Naturwissenschaft überhaupt, besonders zur Morphologie," Stuttg. u. Tübingen, 1820, Band I., Heft 2, p. 199; "Briefe an J. H. Merck von Goethe, &c.," Darmstadt, 1836—letters written in 1785; and "Aus Herder's Nachlass," I., 75.

Vicq-d'Azyr's discovery is mentioned in "Histoire de l'Acad. Roy. des Sciences, Année 1780," Paris, 1784, p. 489, and "Discours sur l'Anatomie," Œuvres, vol. iv., p. 26.

‡ Ueber die verschiedene Form des Intermaxillarknochen in verschiedenen Thieren. Leipzig, 1800.

§ Leuckart, Untersuchungen über den Zwischenkieferknochen des Menschen, Stuttg., 1840.

T. Hamy.* Weber has shown that by macerating the upper jaws in dilute nitric acid, the intermaxillary bones may be separated at as late a period as the first or second year of life.† In addition to this crucial proof of their separate existence in the human cranium, he brings forward the following corroborative facts:—‡

(1) The actual absence of union between the maxillary and intermaxillary bones in the fœtus from the 40th to the 45th day of intra-uterine life.

(2) The occasional persistence of the incisive suture in the adult superior maxilla.

(3) The actual existence of the bone in a distinct form in many cases of cleft palate;§ and

(4) The fact that many other bones, which long remain ununited in the lower animals, coalesce at an early period in the human subject.

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* Hamy, "L'os intermaxillaire de l'homme, &c.," Thése de Paris, 1868.

† Weber. Froriep's Notizen, Bd. xix., No. 18, Jan. 1828, pp. 282 et seq.

‡ Weber, "Handbuch der Zergliederungskunde, &c.," Bonn, 1837, Band I., p. 140.

§ In connection with this point it is worth adding that other pathological conditions than that of cleft palate might be adduced in proof of the existence of intermaxillary bones in man; see, for example, an interesting case of necrosis and separation of the intermaxillary bones, published by Mr. Bryant, Path. Trans., 1858 59, p. 216, and "British Medical Journal," April 4, 1863, p. 339.

In this country the intermaxillary bones have been closely studied by Mr. G. Callender, who thus briefly summarizes their distinctive points :*— "They have a wedge-shaped articular surface, fitting a groove in either superior maxilla; they extend towards the middle line and articulate there; they form the anterior extremity of the palate; they bound and divide the incisor foramina; they assist in forming no inconsiderable portion of the sockets for the incisor teeth; that they do not completely form them is a fact occasionally confirmed by the imperfect character of the sockets which lodge these teeth in those cases of cleft palate which have the intermaxillary bones isolated from the superior maxillæ."

The above characteristics are equally true of the intermaxillary bones of man, and of the premaxillary bones of the lower animals; but the former differ from the latter—first, by their early union with the superior maxillæ; secondly, in being shut off from appearing in the face by the nasal and incisor processes of the superior maxillæ;† and thirdly, in being developed each from two centres of ossification, instead of from one centre, as is the case with the premaxillary bones of the lower animals.‡ The period at which the

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* Philosoph. Trans., 1869, p. 160. † Callender, Op. cit., p. 108.
‡ Leuckart, Op. cit.

premaxillary bones coalesce with the superior maxillæ varies considerably in different animals, but in none does union take place so soon or so rapidly as in the human subject. The anthropoid apes approach most nearly to man in this respect, but in the elephant, the dolphin, the sheep, and some of the smaller carnivora* the premaxillary bones do not remain distinct beyond adult age.

* Topinard, Anthropology, p. 39. Leuckart, op. cit.

CHAPTER II.

THE DEVELOPMENT OF THE PALATE AND SURROUNDING PARTS.*

The parts which have been thus briefly described are formed exclusively from three separate buds or processes, which grow from different points of the rudimentary cranium, and by their subsequent development and coalescence with each other, give rise to the various structures of the face. Of these buds, two, the *first visceral folds*, are placed laterally, growing forward on either side from the lower and outer part of the alæ of the sphenoid bone; while the third, the *frontal* or *fronto-nasal process* grows downwards

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* The above account of the development of the palate is mainly taken from the last edition of Kölliker's Entwicklungsgeschichte (Leipzig, 1879. Zweite Hälfte, p. 465 et seq.); but other authors have also been largely laid under contribution, especially the following:—Coste "Histoire generale et particuliere du developpement des corps organisés"; Goodsir, "Edinburgh Medical and Surgical Journal," vol. 51, pp. 1-6: Huxley, "Elements of Comparative Anatomy"; Foster and Balfour, "Elements of Embryology"; Quain's Anatomy, vol. ii.; Callender, "Philosophical Transactions," 1869. Of these authorities Goodsir and Callender are by far the most important for our present purpose. Coste's researches will be found admirably epitomised both in Follin and Duplay's Traité Elementaire, t. iv., and in the "Nouveau Dictionnaire," &c., vol. xxv., art. Palais.

in the middle line from the extreme front of the cranium. At an early period there appears on the upper edge of each first visceral fold, close to its origin from the cranium and just below the rudimentary eye, a secondary bud which grows rapidly forwards, upwards and towards the middle line. This is the *superior maxillary process* from which the greater part of the upper jaw is subsequently developed. The main portion of the visceral fold, or *inferior maxillary process*, at the same time grows rapidly forwards and downwards, uniting with its fellow on the opposite side to form the lower jaw. There is thus left between the diverging processes a lozenge-shaped opening—the future mouth—the periphery of which is completed above by the fronto-nasal process, already mentioned. The *fronto-nasal process* appears at first in the form of a short, but broad projection, in which may be distinguished a median portion, or fronto-nasal process proper, and two lateral portions, called the *external nasal processes*. From the deeper portion of the central process is formed eventually the nasal septum, while its superficial portion appears in front in the form of a broad process, the extremity of which is excavated in the centre, but prolonged on each side into two points, the *internal nasal processes*, or incisor buds of Coste (Fig. 1).

The rapid growth, which all of the above-named

processes undergo, brings them speedily into contact, and under normal circumstances, union soon takes place in certain definite directions. Thus the superior maxillary processes unite by their free extremities with the fronto-nasal process, thus completing the alveolar arch of the upper jaw, while by their upper borders they coalesce with the adjacent external nasal processes. The external and internal nasal processes, on the other hand, only unite along a small portion of their extremities, the openings thus left between becoming eventually the anterior orifices of the nostrils. The portion of the fronto-nasal process which lies between these openings next grows forwards to form the nose, the openings themselves gradually changing their direction, and approaching nearer to each other, while the external nasal processes are brought forward to form the lateral walls of the organ.

While these processes are going on superficially, a series of deeper changes is in progress, by means of which the common bucco-nasal cavity becomes partitioned off into the nasal fossæ and the mouth. The separation of the two nasal fossæ from each other is provided for by the growth downwards of the deep portion of the fronto-nasal process. This structure, which is at first short, thick, and but very slightly prominent, gradually becomes thinner as it grows down into the bucco-nasal

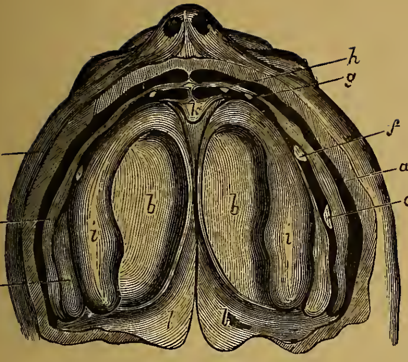

Fig. 5.

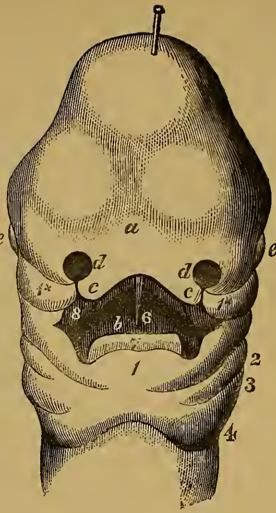

Fig. 1.

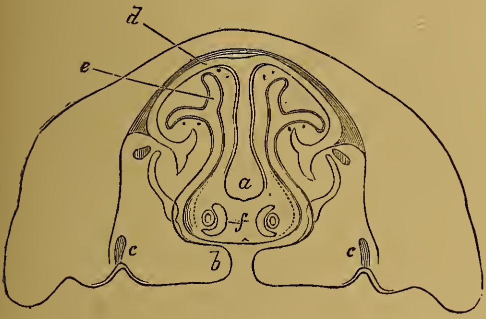

Fig. 4.

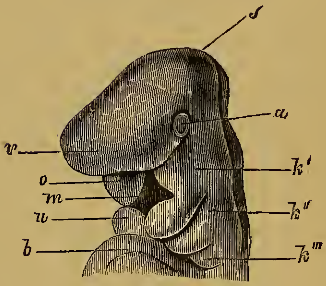

Fig. 2.

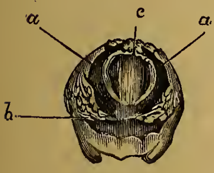

Fig. 7.

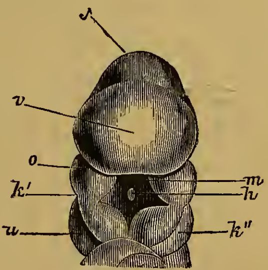

Fig. 3.

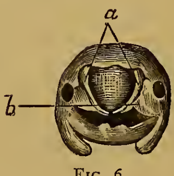

Fig. 6.

Fig. 1.

Mouth of embryo at 38th day.
a. Median bud. *c. c.* Incisor buds. *d d.* Nostrils. *e e.* Eyes. *b.* Mouth. 1. Lower jaw. 1*. Superior maxillary processes. 2, 3 and 4. Second, third and fourth visceral arches. 6. Septum of nose. 7. Tongue. 8. Roof of mouth.

Fig. 2.

Head of a fœtal rabbit, ten days old. x 12.

Fig. 3.

Anterior view of the same.
v. Fore part of head, containing fore-brain. *a*. Eye. *s*. Crown of head, containing mid-brain. *k'*. First visceral arch. *o* and *u*. Superior and inferior maxillary processes. *m*. Mouth. *k''*, *k'''*. Second and third visceral arches.

Fig. 4.

Vertical section of head of fœtal calf, before the union of palatal plates. The lower jaw and tongue have been removed.
a. Septal cartilage. *b*. Palatal process of upper jaw. *c c*. Enamel germ of upper molar teeth. *d*. Cartilaginous roof of *e*. Nasal cavities. *f*. Jacobson's organ.

Fig. 5.

Upper jaw and palate of a fœtus nine weeks old. x 9.
a. Remains of lip. *b*. Palate. *c*. Outer wall of alveolus. *d*. Inner ditto. *k*. Intermaxillary region. *l*. Soft palate, still ununited.

Fig. 6.

Part of human fœtus (four-tenths of an inch long).
a. Plate for ethmoid and turbinate cartilages. *b*. Maxillary lobe prolonged towards middle line to form palate.

Fig. 7.

Same as preceding.
a, *b*, same as Fig. 6. *c*. Frontal-nasal process turned back to expose nodules on its under surface and continuation of ethmoid plates.

cavity, though its lower margin still remains of a considerable thickness, even at the time of its union with the converging halves of the palate. These last named structures are formed from the superior maxillary processes, each of which sends off from its inner surface a flattened process or plate. Each plate is at first directed obliquely upwards, but as it grows towards the median line it assumes a more horizontal direction, until it finally comes into contact and unites with its fellow on the opposite side, and with the free margin of the descending nasal septum. Union takes place from before backwards, the slight projections at the posterior extremity of each palatal plate representing the future uvula, being the last to coalesce (Figs. 4 & 5).

At first all the parts above described, as well as the base of the cranium from which they spring, are formed of soft indifferent tissue, but a deposit of cartilage takes place within them in certain definite directions at a comparatively early period. Thus two separate cartilaginous rods—the *trabeculæ cranii* of Rathke—grow out in front of the upper extremity of the notochord, and, after surrounding the pituitary gland, unite in front, and by their prolongation form the cartilaginous basis of the fronto-nasal process. Later on a cartilaginous plate—the internasal cartilage—grows downwards from between the under surfaces of

the trabeculæ to form the basis of the nasal septum, while the trabeculæ themselves are continued forwards and downwards, surrounding the nasal passages and providing a substratum for the presphenoid, ethmoid, nasal, and premaxillary portions of the skull. At about the same period a cartilaginous rod known as Meckel's cartilage, appears in the inferior maxillary process and grows forwards and downwards till it almost meets its fellow on the opposite side; while a more delicate rod—the pterygo-palatine cartilage—appears in the superior maxillary process. The various bones of the face are formed for the most part from membrane in contiguity with these cartilaginous rods. The nasal bones, the vomer, the ethmoid, and the intermaxillary bones are formed in connection with the trabeculæ cranii and the internasal cartilage. The pterygoid, palatine, and superior maxillary bones are developed within the superior maxillary process; while the lower jaw is developed partly in Meckel's cartilages and partly from membrane covering them.

Such is the general course of development of the structures of the face. It will, however, be necessary to consider, in somewhat greater detail and with especial reference to chronological order, the development of the parts which are of more essential importance in connection with the

subject of cleft palate. The details which follow are mainly derived from the writings of Mr. Callender,* who has given especial attention to this branch of development (Figs. 6 & 7). In the human fœtus at the *sixth week* the fronto-nasal process is still a distinct structure; the external nasal and superior maxillary processes, which have already united, approach it on either side, most nearly above, while the latter can be traced backwards into the bucco-nasal cavity, as a slight elevation towards the middle line—the future palate. The fronto-nasal process continues its forward growth and by the *ninth week* has coalesced with the superior maxillary processes, union beginning from above. At the same period the palatal plates of the superior maxillary processes are commencing to unite from before backwards, but union is not completed until after the *tenth week*, at which date a fissure still extends through the soft palate.* By this time the parts which form the superior maxilla are seen to occupy the position and to have the shape of the future bone. The orbital, palatal and alveolar parts are defined, whilst two considerable projections indicate the position of the nasal and incisor processes, the

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* Philosophical Transactions, 1869, page 163.

† According to Goodsir (loc. cit.) the union of the hard palate is complete at the second month, and the uvula is already formed, though indistinctly, at the tenth week.

latter lying immediately above the thickening at the anterior extremity of the internasal cartilage. Ossification commences by many distinct points at about the *ninth week.*

The vomer and intermaxillary bones are developed in the membrane which covers the internasal cartilage and forms part of the boundaries of the sides of the nostrils. Ossification commences in the anterior part of the vomer, and extends thence to the intermaxillary bones. The latter bones are found at the *twelfth week* to consist of osseous deposits about the posterior edges of the incisor processes of the superior maxillæ, the bony matter subsequently growing downward to form the plate of bone on the inner side of the middle incisor sockets, below, and internal to the course of the incisor branches of the dental nerve. By the *sixteenth week* the intermaxilla is completely developed, and may be traced as a distinct bone forming the front of the hard palate and filling up the notch between the incisor and palatal processes of the superior maxilla. By the *twenty-second week* either intermaxillary bone is in great part fused with the corresponding upper maxilla, though the researches of M. J. Weber* have shown that complete

* Froriep's Notizen, loc. cit.

coalescence is not obtained until the first or second year of extra-uterine life.

It may render this part of the subject more complete if I extract from the chronological table of Beaunis and Bouchard the following notes of the date of development of the parts in which we are especially interested :—

"*Beginning of Third Week.*—First pharyngeal arch. Buccal depression.

End of Third Week.—Coalescence of the inferior maxillary protuberances. Formation of the three last pharyngeal arches.

Fourth Week.—Olfactory fossæ.

Fifth Week.—Ossification of lower jaw.

Sixth Week.—The pharyngeal clefts disappear. The tongue, the larynx, and germs of teeth.

Seventh Week.—Points of ossification of inter-maxillary bone, palate and upper jaw (its first four points.)

Eighth Week.—The two halves of bony palate unite.

Ninth Week.—Osseous nuclei of vomer and malar bone. The union of the hard palate is completed.

Third Month.—Points of ossification for the sphenoid, and nasal bones, squamous portion of temporal. Orbital centre of superior maxillary bone. Commmencement of formation of maxillary sinus. Epiglottis.

Fifth Month.—Osseous points of lateral masses of ethmoid, ossification of germs of teeth. Appearance of germs of permanent teeth."

CHAPTER III.

THE ETIOLOGY OF CLEFT PALATE.

The predisposing causes of cleft palate have often been made the subject of careful research, but a perfectly satisfactory explanation of the way in which the deformity originates is still wanting. The increased interest in the subject, which has been excited during recent years by the successful endeavours of surgeons to remedy the deformity, has indeed led to more extended speculation and conjecture as to its causes, but it cannot be affirmed that we are really any nearer the truth now than we were many years ago. In some instances, the want of substance in the adjacent parts would seem to indicate that the deformity may be due to arrest of growth; but in others, it would appear to arise rather from a failure of union in the median line at the proper time than from any insufficiency in the material required to produce the perfect palate; for in the operation of staphyloraphy the margins of the cleft have, in many cases, supplied more than enough material to fill up the gap. In those cases, on the other

hand, which are clearly instances of arrested growth, no surgical skill could possibly bring the opposite sides into such apposition as to obtain permanent union. We have thus in the instances cited, two processes of physiology illustrated, those, namely, of growth and development —processes markedly distinct from each other. There may obviously be growth independently of development; but development cannot occur without previous as well as coincident growth. We shall see, however, as we proceed, that in some rare instances the deformity may be caused rather by irregularity than by arrest of development.

From a consideration of the processes detailed in the last chapter it will not be very difficult to understand the way in which an arrest of growth or development, affecting one or other of the parts concerned, may lead to any one of the known varieties of hare-lip and cleft palate. For instance, if the superior maxillary processes do not both unite with the superficial portion of the fronto-nasal process, we have bilateral hare-lip, while if one only unites, unilateral hare-lip will be produced. As with the soft parts so with the bones. If the superior maxillary bones do not coalesce with the intermaxillary bones, the result is single or double alveolar fissure, according to whether the arrested union is unilateral or bilateral. If

the superior maxillary bones themselves do not unite in the median line, palatine fissure or true cleft palate will result. Again, the vomer and sphenoid bones may grow too rapidly in comparison with adjacent parts, preventing the union of the halves of the palate and pushing the intermaxillary bones so far in advance of the lateral processes of the superior maxillary bones, as to render them incapable of forming the key to the alveolar arch.* This form of the defect illustrates the irregularity of development to which allusion has already been made. Finally, the intermaxillary bones may not be developed at all.

It will be obvious from the foregoing considerations, that the period at which the arrest of development takes place must determine the character of the deformity. It would appear in some cases to coincide with the whole term of fœtal existence, while other cases can readily be explained on the supposition that it has occurred only at that time when the parts would naturally unite in the median line and intermaxillary sutures. One fact, however, is certain, viz., that no cause which does not come into activity until after the tenth week of intra-uterine life, can have

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* Cf. Grohe, quoted by Follin and Duplay, "Traité Elementaire de Pathologie externe," Paris, 1875, t. iv., p. 833.

the slightest influence on the integrity of the palate.

But it is not sufficient, simply to say that a cleft in the palate is due to arrested growth or arrested development at a certain period of intra-uterine life. It is necessary also—if we would give a full account of the origin of the deformity—to enquire what are the conditions upon which such arrest depends. Various hypotheses have been put forward in connection with this point, which it will be necessary to subject to detailed examination.

The antecedent which strikes one, *à priori*, as being likely to play the most important part in the production of congenital deformities, is that of hereditary influence. But though it will be evident from the facts which I shall presently adduce that the *indirect* influence of heredity in the production of cleft palate is marked and undeniable, no sufficient statistics have as yet been brought forward to show that the actual presence of the deformity in the parent has any direct predisposing influence on its occurrence in the child. In other words, though the defective conditions which precede and accompany the phenomenon of cleft palate are almost certainly to be referred to parental influence, it is extremely doubtful whether cleft palate is in itself transmissible. I am fully aware that such distinguished authori-

ties as Demarquay, Roux, Trelat*, Follin and Duplay,† are inclined to an opposite belief, and their conclusion is supported by the evidence in connection with the analogous deformity of hare-lip.‡ Still, unless accurate records of ancestry could be obtained for three or four degrees of removal, it would be premature to make any positive assertion on the point. I feel, however, that it may be confidently stated that the deformity cannot be produced from any impression received by the mother during pregnancy. In most of the cases which have come immediately under my notice, where one of the parents has had cleft palate, all the children born have been perfectly developed, even though dread of transmitting the deformity was always present in the mind of the mother.

In one case, curiously enough, there are three members of one family with cleft palate, one seventeen years of age, the other thirty, and the third thirty-five; the first and last are ladies, the other a gentleman, who has married, and has

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* Dictionnaire Nouveau de Med. &c. vol. xxv., p. 681.

† Op. cit. t. iv., pp. 643 and 832.

‡ Cf. Trew, Nov. Act. Acad. Natur. Curios., Tom. i. Norimb., 1757, p. 445; and Demarquay, "Gazette Med. de Paris," 1845, p. 52; "Nouveau Dictionnaire de Med.," &c., vol. iv., p. 668; and "Lancet," May 16, 1868; Jardine Murray, "Brit. and For. Med-Chi. Review," vol. xxvi., p. 502; "British Medical Journal," April 18, 1863, p. 412.

a family without any trace of the father's deformity. In these cases no instance of cleft palate could be found either among the ancestors or the collateral branches of the family; but it will be interesting to watch whether in the following generations any traces spring up again, for cases of immediate transmission seem but rarely to have been placed on record.

In the case of another family, however, I have obtained the following remarkable history :—

G. H. C., born 1853. Perfect.

L. C., born 1855. Single harelip and cleft palate.

J. F. C., born 1856. Perfect.

F. W. C., born 1860. Double harelip and cleft palate.

H. E. C., born 1863. Perfect.

The maternal grandmother also had cleft palate.

Passing on to the *indirect* influence of heredity in the causation of cleft palate, we are still met by many contradictory statements and hypotheses. There can be no doubt that fissured palate is, in a certain proportion of cases, associated with other anomalies and defects of development, which can only be attributed to parental influence. But at the same time it must be admitted that there are many cases of the deformity in which every other organ of the body is perfectly developed, the patients being gifted with a high degree

of intelligence. In short, the premises for forming a definite conclusion on the subject are very insufficient, and our deductions must, in the present state of the enquiry, be based to a very unsatisfactory degree on arguments from analogy.

The frequent association of cleft palate with defective development of the brain has long been observed,* and various hypotheses have been put forward to explain the connection. Thus, in the early part of the century, Tiedemann† observed that in certain cases of cleft palate the nerves of smell were wanting, or imperfectly formed, and he was therefore inclined to attribute the deformity in the palate to a deficient development of the framework of the olfactory organ, consequent upon the nervous defect. This view, however, never met with any general acceptance, and M. J. Weber—no mean authority on the subject—states‡ that he has never seen the olfactory nerves absent in any case of fissured palate. According to Dr. Engel, on the other hand the deformity is due to increased breadth of the anterior portion of the head, caused by a variety of conditions of embryonic life,

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* Leuckart, Op. cit.

† Zeitschrift für Physiologie, Bd. 1, Heft 1, Heidelberg, 1844, p. 71, et seq.

‡ Froriep's Notizen, loc. cit.

such as hernia cerebri, dropsy of the third ventricle or of the anterior cornua of the lateral ventricles, or excessive development of the anterior cerebral lobes. Or, in other words, to a purely mechanical disturbance of the relative position of the parts involved. But while admitting the accuracy of Dr. Engel's observations, it is impossible to accept his deduction from them. For cleft palate is found to occur more frequently in connection with a microcephalic skull than under the conditions quoted by Dr. Engel; and thus his hypothesis, even if true, would only explain the causation of a limited proportion of cases. It is far more probable, however, that the relations between the two deformities—the cerebral and the palatal—is not one of causation, but one of concurrence—both being common effects of a grave vice in the developmental energy of the fœtus.

Within recent years a wider scope has been given to the enquiry by Dr. Langdon Down, who has convinced himself that there is a constant relation between malformation of the palate and defective cerebral development. It is true that Dr. Down has observed actual clefts of the palate in only 0.5 per cent. of his cases of congenital idiocy, but this is a very much larger proportion than obtains among the general population, Grenser having only found nine cases of the de-

formity in 14,466 children, or one in 1607;* and, moreover, there is a distinct relation between fissured palate and those minor degrees of deformity which Dr. Down actually noted, both being in all probability due to arrested development. Dr. Down states that he made "a very large number of careful measurements of the mouths of the congenitally feeble-minded and of intelligent persons of the same age, with the result of indicating, with some few exceptions, a markedly diminished width between the posterior bicuspids of the two sides. The exceptions were some few cases of macrocephalic idiots, who had inordinately large crania, depending in some cases on hypertrophy of the brain, or more frequently on chronic hydrocephalus. In these exceptional cases the palates were as widely in excess as usually they are less than the normal width. One result, or rather one accompaniment of this narrowing is the inordinate vaulting of the palate. The palate assumes a roof-like form. The vaulting is not simply apparent from the approximation of the teeth of the two sides, it is absolute—the line of junction between the palatal bones occupying a higher plane." "The cause of the frequent excessive vaulting of the palate," adds Dr. Down, "is not quite clear; it may possibly arise,

* Rouge, Op. cit.

as has been suggested, from arrest of development of the sphenoid bone, or defective development of the vomer."* All perhaps, that we can safely say on the subject at present is that cleft palate, hare-lip, and other similar anomalies of development do frequently occur in conjunction with faulty development of the brain, whether bilateral or unilateral, hypertrophic or atrophic; and it is quite possible that the two kinds of deformity may be related to each other as cause and effect. But the facts that hemicephalic and microcephalic infants are born with perfect palates, while the subjects of palatal deformity are in many cases of high intellectual power, would appear to show that the two deformities are rather the combined effects of a common cause. Whichever view, however, is adopted, it is fairly certain that the ultimate antecedent of both defects is hereditary influence, though the present state of knowledge does not allow us to penetrate to the hidden intermediate links of causation.

But though we cannot give a full account of the indirect ways in which hereditary influence

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* Trans. Odonto. Society, vol. iv., 1872. It is only fair to state that Dr. Down's views have been opposed and his statistics challenged by other observers, *v.* "An enquiry into the causes of Irregularities in the Development of the Teeth," by Dr. Norman Kingsley of New York.

operates in the production of palatal deformity, there are some few circumstances which, as providing a possible clue for future enquiry, must not be omitted from the present chapter. Thus it seems to have been proved fairly conclusively that irregularities and malformations of the upper jaw and palate are met with much more frequently amongst highly civilized races than amongst those who have lived or are still living under semi-barbarous conditions. And it would further appear that the same irregularities are of more frequent occurrence amongst the upper and middle grades of society than amongst the working classes. The two hundred ancient skulls examined in 1864 by Messrs. Cartwright and Coleman in the crypt of Hythe Church, presented without exception, perfect maxillæ and extremely well-developed alveolar arches; while the more extensive researches of Mr. J. R. Mummery, extending to upwards of 3000 skulls of ancient and modern uncivilized races, lead to the conclusion that the perfect type of both dental and maxillary arches has been uniformly maintained amongst nations of simple habits and lives. Again, Dr. Nicholls of New York, who has examined the mouths of thousands of Indians and Chinese, affirms* that the jaws of both races are univer-

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* Dr. Norman Kingsley, Op. cit.

sally well-formed and amply developed. If with these statements we contrast the statistics of Dr. Down, and the universal experience as to the occurrence of fissured and malformed palates amongst our own countrymen, we shall be led to the inevitable conclusion that the relation between a high state of civilization and a high proportion of palatal deformity is something more than a mere matter of coincidence. And the strength of such conclusion will not be lessened by the statements of Walther* and Langenbeck,† both of whom maintain that the severer forms of cleft palate have become more common within their own recollection. To draw more precise conclusions from considerations such as the above would be beyond the scope of the present article, but it may not perhaps be out of place to suggest that the difference between the conditions of civilized and uncivilized life is quite as much a matter of increased nervous strain as of changed physical environment; that the overtaxed nervous system, which in the parent manifested itself only by functional instability and subjective remonstrance, may, in the child, issue in objective defect and an actual refusal to complete its allotted task. That the nervous system is

* Graefe und Walther's Journal, Bd. 21, Heft 2, p. 175, Berlin, 1834.

† Neue Bibliothek für die Chirurgie, Bd. 4, Heft 3, p. 492.

a wondrous factor in development will be readily conceded. Now the fifth pair of nerves plays a most important part in the region under discussion. Of this pair the late Dr. Anstie* remarked, "The nervous centre in which the trigeminus is implanted is, of all nervous centres, the one which, in the human subject, is most liable to congenital imperfection of the kind which necessitates a breakdown in its governing functions at special crises in the development of the organism." This being the case, the occurrence of deformities of the mouth in highly civilized races cannot be a matter of wonder, seeing that the competition for existence not only pre-developes the young powers, but also exhausts them before they have had time to arrive at maturity. Why the trigeminus nerve centre should be the most liable to congenital malformation is a question which still remains to be solved.

The hereditary antecedents of cleft palate which have been discussed above are such as may be presumed to have been accumulating force through generations. But it must not be forgotten that the deformity may possibly be due to defective physical surroundings operating on the mother, not so much as the parent but as the nourisher of the child within her womb. Thus Dr. Ogle

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* "Lancet," 1866, Vol. I., p. 654.

has called attention to the fact that 99 per cent. of the lion cubs born in the London Zoological Gardens have cleft palates, and he has referred this curious phenomenon to the artificial diet necessitated by the enforced captivity. It has indeed been contended in reply to this theory that the experience of the London Zoological Society is exceptional, differing from that of other menageries, and Mr. Pollock has suggested* that we must seek for the cause of the phenomenon amongst other conditions than the food-supply. It is true that amongst the lion cubs born in the Dublin Gardens cleft palate is seldom noticed; but it is stated that it used to occur quite as frequently as in London, when the feeding was conducted in a similar way, viz., by supplying only the meat of large animals. Now, however, that the lions are given a goat twice a week, which they can eat bones and all, the proportion of cleft palates has become quite insignificant. These observations seem to point to the possibility of cleft palate in the human subject being due to an analogous departure from a natural diet amongst civilized nations, but it is at all times perilous to argue from the lower animals to man. At any rate the evidence before us does not at present admit of anything more than conjecture.

* "Holmes' System of Surgery," vol. iv., p. 420.

Lastly, it may be stated that Mr. Lawson Tait has expressed his belief that cleft palate is endemic in some localities, but hitherto no attempt has been made to prove the statement.

CHAPTER IV.

ON THE ANATOMY AND PHYSIOLOGY OF CLEFT PALATE.

THE term "cleft of the palate" is applied to any fissure caused by defect in either the soft or the hard palate, or in both, the terms "soft" and "hard" being affixed according to the region involved. Clefts of the palate may be conveniently classified under two headings, namely, the Congenital and the Acquired. In the former are included all the malformations noticed at birth; in the latter, those defects which have resulted from loss of substance through disease, whether inherited or acquired. These varieties may be further sub-divided into partial and complete cleft, according as a part or the whole of the palate is implicated. There may be a cleft through the uvula alone; or through the uvula and soft palate; or through the uvula, soft palate, and hard palate; or through the whole of the soft and hard palate and through the alveolus in front. This last form is invariably associated with single or double hare-lip, and the vomer may be seen either standing out free or attached to one or other half of the palate; my own

observations induce me to think that this bone is more often attached to the right than to the left side of the cleft, and this view is confirmed by the observations of Rouge.* In some rare intances the alveolus alone may be fissured. Lastly, cases have been recorded in which the uvula, the soft palate, and the hard palate have, respectively, been absent, whilst, still more rarely, the intermaxillary bone has been found undeveloped, thus producing fissure in the lip and alveolus in the median line. Cases of this nature have been described and figured by Leuckart,† Von Ammon,‡ and Bouisson.§ There is also an example of this malformation in the museum of the Royal College of Surgeons, London. When the soft palate is fissured, the lesion is invariably in the median line; but when the hard palate is imperfect, the cleft is placed somewhat laterally.

Velpeau has affirmed that double cleft of the palate has never yet been seen, and a consideration of the way in which the parts are developed will make it abundantly plain that such a deformity cannot possibly exist except at the extreme anterior part of the palate, where the

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* Op. cit.

† Leuckart. Op. cit. Table viii., fig. 30.

‡ Von Ammon. Die Chir. Pathol. in Abbildungen. Table iv., fig. 19.

§ Bouisson. Rech. sur les fissures Congenitales.

presence of the united intermaxillary bones in their normal position may naturally lead to a bifurcation of the cleft. This was evidently the condition present in the case quoted by Professor Humphry* as one of double cleft palate, while on the other hand the case figured in plates 2 and 3, which was described in an earlier edition of this work as an instance of the same deformity, is in reality clearly an instance of fissure through the alveolus and the hard and soft palate, with the vomer attached to the palatine process of the superior maxillary bone along its anterior third. These plates have been most faithfully copied from the skull and original drawings of the mouth, in the possession of my friend Mr. Christopher Heath, to whom I am greatly indebted for the privilege of presenting this interesting case to my readers. Mr. Heath was also kind enough to give me the opportunity of witnessing an operation, which he performed for hare-lip, on a little patient who had, apparently, a double cleft palate of the same character as that shown in plates 1 and 2.

In connection with these cases it is interesting to notice the change which the palate undergoes in later years, when the operation for harelip has been performed during infancy. Thus, by the

* A Treatise on the Human Skeleton, p. 214.

time the child has arrived at the age of ten or twelve years, the dental arch instead of having the breadth of the normal jaw (as compared with the size of the rest of the head), is found to be exceedingly contracted, the two margins of the fissure in the alveolar ridge being very near to each other, if not in actual contact. In fact, the portion of the palate, which in childhood produced the appearance of a double cleft will have changed its position, and the patient will have that form of palate, which is found in most of these severe cases. The change is produced, in my opinion, by the contraction of the lip, after the operation has been performed on it. The steady pressure which is exerted on the two portions of the jaw, as the wound heals, gradually approximates the anterior margins of the cleft, and at the same time compels the central portion of the palate consisting of the misplaced vomer, to assume a vertical instead of an horizontal position, as at birth. A careful examination of the drawings in reference to this point, will I think bear out the conclusion indicated.

For the anatomical aspects of cleft palate we are largely indebted to the late Sir William Fergusson who once, in the dissecting-room, had the rare good fortune to meet with a case of the deformity, an account of which he gave in a paper read before the Medical and Chirurgical Society on the 10th

December, 1844. On the conclusions which he came to as to the physiology of the parts, he based his method of treatment for this condition of the palate, and put forward the plan of dividing the levatores palati muscles, in order to obtain perfect control over the palate during the operation.

The value of this account of the anatomy and physiology of cleft palate cannot be overestimated, since, in addition to the light it threw upon the operator's work, it has of late years become the basis of treatment by mechanical means. Under these circumstances I feel I cannot do better than give to my readers the following extract in Fergusson's own words:—*

"Few have had the opportunity of dissecting a cleft palate, and some notice of a specimen in my possession will form an appropriate introduction to the views developed in this paper. The fissure in this instance implicates a portion of the hard as well as the whole soft palate, and is such as the surgeon frequently meets with in practice. The specimen was procured in the dissecting-room from the mouth of an aged female subject.

"In the examination of this preparation there are several marked differences between it and

* Trans. Med. Chi. Society for 1845.

the parts in a more natural state. The superior constrictor muscle is more fully developed than under ordinary circumstances, and its upper margin, extending between the basilar process of the occipital bone and the internal pterygoid plate, is particularly distinct. This part of the muscles forms a sort of semicircular loop, in which the levator palati muscle seems to be suspended.

"The pharnyx has been laid open by a perpendicular incision through the constrictors in the mesial line, and the movable portion of the palate has been dissected on one side. The circumflexus, or tensor palati, differs little from the natural condition, and the levator palati is much as it is usually met with, its lower end spreading out in all directions on the soft palate. The palato-pharyngeus consists of two distinct bundles of fibres; one the smaller of the two, running between the tensor and levator palati; the other, a mass equal in size to a goose-quill, seems to form the principal part of the free portion of the palate; and posteriorly its fibres, previous to joining those of the other bundle, form the whole muscular portion of the posterior pillar of the fauces. This muscle arises by tendinous and fleshy fibres from the posterior margin of the osseous palate and the inner surface of the internal pterygoid plate, and takes its usual course and attachment posteriorly. A bundle of fibres

about the size of a crow-quill, can be traced along the lower border of the inner margin of the soft flap. These fibres extend between the posterior margin of the hard palate and the uvula, and are probably analogous to the azygos uvulæ. The palato-glossus can scarcely be distinguished. A small arterial twig, doubtless a branch of the ascending pharyngeal artery, can be traced between the levator and tensor palati muscles. The throat and upper part of the pharynx generally is smaller than in the well-formed state, but the deficiency in the mesial line of the palate seems more the result of a want of union than of the usual materials of the velum.

"The act of deglutition in the natural state of the parts, while food is passing through the upper end of the pharynx, has been a subject of considerable speculation among physiologists, especially with reference to the manner in which the communication betwixt that bag and the posterior nares is closed for the time being.

"It has been pointed out by Dzondi and Müller that the palato-pharyngei muscles, when fixed in the soft tissues at their upper ends—as in the natural state of the velum—must, during contraction, tend towards the mesial line, and so by their approximation diminish the capacity of the throat. But in the cleft state there is no central fixed line, and each muscle, acting be-

tween its extreme attachments—viz., the palatine bones above and the thyroid cartilage below—must, during contraction, tend to widen the throat rather than close it. In the condition alluded to, these muscles, joined with the levatores palati, have the effect of enlarging the gap in the mesial line. It is evident that the doctrine of the above-named physiologist will not account for the closing of the aperture under these circumstances, and how then is the occlusion effected? I am not aware that it has ever been accounted for. Malgaigne,* in describing the simple fissure of the palate, has alluded to the approximation of the edges during deglutition, 'by a muscular action,' as he says, 'of which it is difficult to give an explanation.' I think that any one who looks at the preparation in my possession can have no doubt as to this movement. The superior constrictor has evidently the power of throwing the two lateral portions of the palate forwards and inwards, so that they are forced into contact in the mesial line, and thus the back of the fissure is closed, while the constrictor is acting on the upper part of the pharynx, like a broad semicircular band. The upper border of this muscle, as it is seen in the preparation alluded to, must evidently have the effect described, and

* "Manuel de Médecine Opératoire," Paris, 1834, p. 486.

the lower fibres will act still more effectually, in consequence of there being no connection mesially to prevent them starting forwards during contraction, so as to stretch across, almost in a direct line, extending between the lateral attachments of each muscle. Some of the fibres of the middle constrictor may also aid in this movement. The palato-pharyngei muscles are thus forced into contact, and their ends, behind and below the parts so held in apposition, may then act in the manner described by Müller, while possibly the thickness of the two portions of the soft palate may be increased by the contraction of each palato-pharyngeal muscle at the points of contact. The azygos uvulæ may probably contribute to the latter effect.

"As we look into the open mouth, the flaps may be seen under four different conditions. First. If the parts be not irritated in any way, the gap will be quite conspicuous, the lateral flaps will be distinct, and the posterior nares, with the upper end of the pharynx, will be observed above and behind. Second. If the flaps be touched, they will in all probability be jerked upwards by a motion seemingly commencing at the middle of each. Third. If the parts be further irritated, as by pushing the finger against them into the fissure, each flap is forcibly drawn upwards and outwards, and can scarcely be dis-

tinguished from the rest of the parts, forming the sides of the nostrils and throat. And, fourth. If the parts further back be irritated, as in the second act of deglutition, the margins of the fissure are forced together, by the action of the superior constrictor muscle, already described in my observations on this process, in an earlier part of the paper.

"All these conditions and movements are, in my opinion, very readily accounted for. In the first instance the parts may be deemed in a quiescent state; in the second, the levatores palati are called into play, and move the flaps as described; and in the third, these muscles act still more forcibly, and the palato-pharyngei will join in drawing the parts outwards. The fourth condition I need not again describe.

"If the free margin on one side of the fissure be seized with the forceps, drawn towards the mesial line, and the flap be then irritated, it will be drawn upwards and outwards with remarkable force; this movement, it is evident, can only be effected by two muscles, the levator palati and palato-pharyngeus. These muscles, then, I consider the chief mechanical obstacles to the junction of the margins in the mesial line. Hitherto I have taken no notice of the action of the circumflexus, or tensor palati. I am inclined to think that its action is very limited, and probably, as

the dissection in my possession would indicate, is greater upon the parts outside the posterior pillar than on those contiguous to the fissure. Neither have I alluded specially to the action of the palato-glossus, because, though it might with a feeble power incline the soft palate downwards, its influence, as regards the practical view I am now taking, is completely counteracted by the more powerful muscles connected with the palate above."

There can be no doubt that the plan suggested by Fergusson, in the concluding portion of his paper, viz., to divide the levatores palati, palato-pharyngei, and palato-glossi muscles, is by far the most scientific and certain way of proceeding in order to get an easy approximation of the margins of the cleft; and the details* of the cases (between 300 and 400 in number) which he subsequently treated, clearly show the soundness of the views put forward in 1844.

One important point in connection with the anatomy of cleft palate seems, however, to have been entirely overlooked. That is the deformity invariably existing in such cases above and behind the soft palate, and in consequence of which the upper part of the pharynx entirely loses its

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* Lectures on the "Progress of Anatomy and Surgery during the present Century," delivered at the Royal College of Surgeons, 1867.

dome-like form, the ends of the turbinated bones being exposed to view, and the proper outline of the posterior nares absent.* Where the cleft extends into the hard palate to any extent, the septum of the nose will be found incomplete, to a corresponding degree.

When the palate which has been subjected to a surgical operation is brought into play, though the parts would seem to be perfect, much dissatisfaction is often felt at the disagreeable tone of the voice, both by patient and operator. There can be little question that in very many of these cases this has arisen from the free communication that exists between the upper part of the pharynx and the cavity of the nose, even though they be separated from the mouth partially or completely by the restored velum palati.

It would be difficult to imagine any surgical operation that could possibly restore the posterior nares to their natural condition, and yet it is tolerably certain that we cannot expect to get a natural tone of voice, accompanied by intelligible articulation, unless something can be done either surgically or mechanically to reproduce the parts

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* Passévant relates a case in which he attached the uvula (after the cleft had been closed) to the back of the pharynx, in order to improve the voice; but the practice does not seem to have become at all general.

which have remained undeveloped in the region of the nose and pharynx. For as the propagation of clear and agreeable sound is dependent to such a degree on the shape of the passages through which it travels, the importance of considering the nasal region in the treatment of congenital cleft palate must not be overlooked.

Nature has to some extent endeavoured to remedy the defect in this region, by the growth of what appear to be nasal polypi but are really adenoid bodies. In over a hundred and seventy cases that I have examined, I have found them present; they may be attached to the anterior portion of the nares, or to the back of the pharynx, or between the turbinated bones. They are usually found in pairs, but when single, they occur in cases of complete fissure of the hard and soft palate, and alveolus.

In the infant six months after birth, I have found (post-mortem) thickening of the mucous membrane at the point where these adenoid bodies are most frequently attached in later years, that is, near the apex of the cleft. In a case seven years of age, they were well defined; in a girl seventeen years of age they were so large as to completely block up the cleft and render the patient's speech quite intelligible, and in a patient sixty-eight years of age, they were small, symmetrical, and of a denser consistence

than in the younger. I have carefully prepared drawings of the growths, of the same size as they appear in nature. They cannot always be seen without the aid of a mirror, and are very likely to be confounded with the spongy bones, until a good many observations have been made and the finger has been educated to diagnose their precise character.

These growths were first described in special connection with congenital cleft palate by myself in 1868, but I am not prepared to say that they are present in even the majority of cases, still less in all; yet the fact of my finding them in so many cases that I have had the opportunity of seeing, is, I think, sufficient to justify me in making the matter known, in order to obtain the result of more extensive observations from others.

It seems only reasonable to suppose that their presence has in many cases been the secret of success in the operation of Staphyloraphy, although the surgeon may have taken no note of them.

They are different in character from the bodies frequently found in the naso-pharyngeal cavity, and described by Kolliker,* and they must not be confounded with the hypertrophied glandular bodies (adenoid tissue) of Luschka.† I believe

* Miscroscopic Anatomy.

† Cohen. Diseases of the Throat. New York, 1872.

† Der Schlundkorp der Menschen. Tübingen, 1868.

them to be identical, however, with the growths described by Mayer as "adenoid vegetations," * and their appearance approaches in many respects the description published by that author. There seems to be, however, considerable diversity of opinion as to their precise character, and when I find such men as Henle, Mayer, and Luschka† at variance, it would be an affectation for me to offer a decisive opinion.

* Copenhagen. Hospitals Tidende. Nov. 4th and 11th, 186 London Medical Chirurgical Transactions, 1870.

† Luschka. Archiv. für Mikroskopische Anatomie, 1868. Vol. iv., pt. 1.

CHAPTER V.

CLASSIFICATION OF DEFORMITIES OF THE UPPER JAW.*

Beyond those well-marked deformities of the upper jaw known as congenital cleft palate, and fissured alveolus, we have others of a more or less severe form that are of sufficient importance to attract notice on account of the defective articulation they may be associated with, or that may excite interest from the endeavours that have been made from time to time to translate their pathological signification.

The question has been invested with an unnecessary amount of obscurity from the variety of terms that have been in use to express very often the same class of deformity, thus at the present time there would be no difficulty in finding in the works dealing with this and allied subjects such names as—*(a)* V-shaped maxillæ, (*b*) contracted arch, (*c*) saddle-shaped palate, (*d*) high roof, (*e*) vaulted palate, *(f)* narrow or contracted

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* The main portion of this Chapter formed the subject of a paper read before the Odontological Society of Great Britain, Feb. 1880.

palate, *(g)* highly arched palate, (*h*) keel-shaped palate, (*i*) Gothic palate, *(j)* upsilon palate.

These terms are used in many cases without any accompanying explanation of the meaning attached to them by the author, and since in most instances they have no definite signification in themselves, confusion and misconception have very often arisen in the minds of those who have had to study and investigate the class of cases under discussion.

If the importance of the subject be such as to have induced so many authors to have adopted so varying a nomenclature, it seems self-evident that a more precise and scientific classification is necessary.

It would be but little to the purpose were anyone to propose a simply arbitrary set of terms to supersede those that are now in use. They would be open to the objections urged against existing names, and would, if merely arbitrary, still lack that degree of scientific accuracy that is essential to the successful prosecution of a purely morphological investigation.

The chief obstacle to the attainment of the necessary end may be said to have been due to the absence of any exact standard of an absolutely perfect form of jaw.

To say that a well-developed dental arch will correspond in outline with one or other of the

conic sections is only to remove the difficulty one step further off and render a complex subject still more difficult of description.

My investigations as to the correlation between the palate and cranium, commencing about ten years ago, compelled me to take some record of the dental arch in such a manner that it could be easily recorded and tabulated. The ordinary terms, such as paraboloid, elliptical, horse-shoe shaped, and others were quite useless for my purpose, on account of the almost infinite variety of form that each term might be made to include.

After a series of measurements and experiments that I need not now describe, I arrived at the conclusion that the triangle was the best geometrical figure for the object that I had in view, as it gave in the simplest and most diagramatic form two at least of the measurements that were required, namely, the length and breadth of the dental arch. The interbicuspid measurement I had not at that time thought of, except as an independent item, to be measured apart from the length and breadth.

Desiring to form a triangle that should be applicable to the largest number of cases, whether edentulous or not, and capable of use with approximate accuracy to all races alike, I decided to form the base by an imaginary line drawn from the centre of the distal surface of the

second molar on each side, as near to the level of the alveolus as the third molar (if present) would admit of. By choosing the second in preference to the third molar, I disposed of the liability to error arising from abnormalities of the wisdom tooth, and at the same time was enabled to take my measurements at any period after the thirteenth year of the patient's existence.

One other object was gained by the choice of this position, and that was that the absence of the molars on one side of the mouth did not of necessity render measurement impossible, as the centre of the distal surface corresponds very nearly with the centre of the alveolar ridge, which in this region is generally well marked.

The base being thus obtained, the remainder of the triangle was produced by lines drawn from the point of contact of the mesial surfaces of the two central incisor teeth to the extremities of the base line already referred to. This incisive point, as I shall hereafter call it, still keeps the angles of the triangle upon the central line of the alveolar ridge, so that in this respect again we measure from a point of least variation.

We have thus procured a triangle, giving at the molars the breadth of the jaw, and by a line drawn from the apex of the triangle to the centre of the base line the length of the jaw, exclusive, of course, of the space occupied by the third

molars. My own observations in connection with cleft palate, and the observations of Dr. Smith, of Edinburgh, and Dr. Langdon Down and Mr. Charles Tomes, had, however, caused me to pay special attention to the measurement of the space between the bicuspids from either side of the mouth.

This interbicuspid measurement has always been deemed a very important one, and most writers on the deformities of the palate have referred to it.

Contrary to the practice of some observers, I was induced to choose the second bicuspid as the best point of observation, as it corresponds with the position occupied by the second molar of the primary dentition, and is altogether the tooth subject to the least variation of position, if the changes incident to the growth of the jaw be normal in character. Whilst on the other hand, given an abnormally-developed jaw, we may be tolerably certain that the second bicuspids will to some extent be affected. The interbicuspid measurement was, therefore, taken at the line of junction of the neck of the tooth with the margin of the alveolus on either side of the jaw,* this position

* Mr. Charles S. Tomes, in discussing this paper at the Odontological Society, pointed out the desirability of measuring the bicuspids from the centre of the crown, in a manner similar to the molar measurement. I was at the time disposed to act upon this criticism,

being chosen so as to avoid the inaccuracies likely to occur in the event of a largely-developed bicuspid crown.

At a distance from the base, corresponding with the distance of the second bicuspids from the distal surface of the second molar, this inter-bicuspid line was allowed to traverse the triangle. These lines and distances were obtained with an ordinary pair of compasses, and measured off by means of a millimeter rule. Beyond this, the height of the palate was taken, together with the total length (in the skull), and also its transverse and antero-posterior curves.

In the method that I have thus endeavoured to describe there are certain sources of inaccuracy and errors of observation that may be readily seen, and to some extent allowed for.

Thus, deformity of the palate, arising from premature ossification of the intermaxillary or palato-maxillary sutures, would of necessity invalidate the tracings and measurements of the palate, whilst abnormally large crowns to the teeth, or extreme irregularity in the crowns, would quite as obviously render comparatively valueless the data on which the triangle was constructed. Still,

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but further consideration induced me to abide by my original plan, and chiefly for this reason: that either inversion or eversion of the crown of the bicuspid would seriously interfere with the true inter-bicuspid measurement.

if these sources of error be fully recognized and carefully allowed for, an approximately accurate diagram may be obtained.

My observations were in the first instance directed solely with the object of ascertaining certain normal measurements, and the first set of these dimensions were taken by means of strips of lead, accurately moulded to the contour of the palate in different positions, the results being immedidiately outlined on cardboard; the measurements were then taken off by means of compasses and a millimeter rule.

But beyond these dimensions, I obtained with the compasses the dental triangle to which I have already directed attention. The first set of observations having special reference to the palate,* and the second to the alveolar and dental arches.

Two main facts are deducible from the data obtained in the second instance; first: that the best type of well-developed English jaw will give an equilateral triangle as the result of measurements taken in the way I have described. Secondly: that the interbicuspid line will fall upon the triangle some five-tenths in the perpendicular from the base, and that the extremities of the interbicuspid line will pass well beyond the boundary of the triangle on either side.

Further observations are of course desirable in

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* See Chapter I.

order to render these statements absolute facts. I have taken an English jaw as the standard type, as it will be found that with other nationalities there is, I think, the possibility of obtaining certain race distinctions from the character of the triangle. Records for such a purpose must, however, be extended over a very much larger number of skulls than I have at present been able to examine. The facts, however, that I have already obtained are sufficient for the special purpose to which this chapter is devoted, whilst we look for the help to be obtained from many workers in various places before we can assert any definite conclusions beyond those already given.

Having obtained what appeared to be a reliable standard figure, my first impulse naturally was to apply the same method of measurement to the cases of deformities of the upper jaw that were so frequently being brought under my notice.

The results were so marked and special in their characteristics that there seemed little question that the difficulty of classifying the various forms submitted to the test of the triangle was in a fair way of being removed. Continued investigations confirmed my first impressions, and those investigations I have endeavoured to reduce to a practical issue by making them the basis of a nomenclature that I now venture to submit to the opinion of the profession.

Taking typical cases of strongly-marked deformity, I noticed that the nature of the triangle and the position of the interbicuspid line in its relation to the triangle had a definite and intelligible meaning, and further that I could transfer to a diagram records of a case that should be capable of a precise interpretation.

Not taking into account an almost endless variety of deformities that possessed some slight modification, as compared with the more pronounced types, it yet seemed quite possible to classify a sufficient number according to rules that were capable of a fairly general application.

Thus to one or other of the divisions, long, short, large, small, prominent pre-maxillary region, deficient pre-maxillary region, and true V-shaped arch, I found it possible to assign each case.

These were scarcely satisfactory terms to use, however, and I have therefore adopted a set of words already known in cranial morphology, modifying their terminations only, in order to avoid a certain hybrid term that might otherwise have been created.

Following the order of classes already given, we have then the dolichoid,* the brachoid, the

* In the discussion on this subject that took place at the Odontological Society (Transactions Odonto. Soc., vol. XII., Nos. 4 and 6) exception was taken to the termination "oid" used in this classi-

macroid, the microid, the premaxillary prognathous, the premaxillary hypognathous jaw, and

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fication, as being inaccurate. My friend, the Rev. Henry Belcher, M.A., &c., Classical Master at King's College, London, however, confirms my judgment in the following note:—"The suffix 'oid,' adopted mainly by medical men for the purpose of comparative epithets, such as spheno*id*, encephal*oid*, mast*oid*, but also to a less extent by scientific men, for the same purpose; e.g., aster*oid*, planet*oid*, coll*oid* is derived from the Greek word *εἶδος.*

"*εἶδος* (Eidos) signifies that which is seen: the form, shape, exterior likeness or manifestation; it connotes physical outline, and is commonly used by Greek authors in a sense opposed to interior facts: i.e., the understanding, wit, &c. Hence the suffix *oid* signifies not merely *likeness* in the widest sense, as when we compare abstract ideas and speak of them as *like*, but likeness in a physical sense, having a shape or form like to some type selected as the model of the general idea. Hence Spheno*id* will signify having the *shape* of a wedge; Encephl*oid*, having a physical likeness to the brain; Mast*oid*, having the appearance of the female breast. In their strict sense the Greek equivalents for these words are found in Greek philosophical authors (e.g., Aristotle uses *μαστοειδής* and Theophrastus uses *σφηνοειδής.*) The meaning of the suffix *oid* having thus been briefly determined, its use requires brief consideration. It is chiefly compounded with *Substantives*, as in all the cases quoted above; and also in the frequently used words hæmorrhoids, alkaloids, albuminoids; but its composition with adjectives is not uncommon. Plato (Rep. 509 A) *οὕτω καὶ ἐνταῦθα ἀγαθοειδῆ μέν νομίζειν ταῦτ ἀμφότερα ὀρθὸν.* 'Yet he thinks it fair that both these matters should be reckoned to present the *exterior phenomena of goodness*' (agathoid). Dio Cassius also uses *κακοειδής*—to mean ugly—i.e., having the exterior appearance of badness (the Greeks connect the notion of ugliness and moral turpitude very closely, *e.g.*, *αισχρός*). Hence it is quite within the liberty of the maker of new words by means of the suffix *oid* to use any adjectives he prefers; makroid, in this sense, means having the physical appearance of length; dolichoid, having the physical appearance of unusual length. As euphony has something to do with the formation of new words, these expressions sound better than *makrik*, or *dolichik*, than *makrous*, or *dolichous* (to which the objection of hybridism arises), or than any other usual compound."

the true V-shaped arch of congenital idiocy, to which I have assigned the name lambdoid.

In order to render the subject complete, I propose now to give first the name (with its derivation) and definition of each class, and then pass on to a concise description of a typical case.

1. Dolichoid Jaw (Δολιχὸς, *long*).

Definition.—A term applied to an upper jaw in which, with an average or less than average

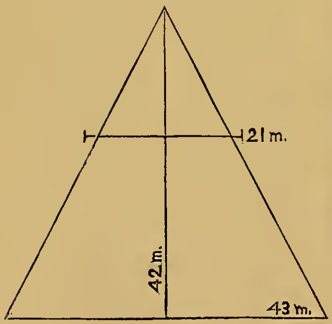

Fig. (8).
Triangle of Dolichoid Jaw.

Fig. (9).
Dolichoid Jaw.

length from base to apex of triangle, the interbicuspid line will be found resting at its extremities

upon the sides of the triangle, thereby showing the degree of parallelism (tending even to bicuspid contraction) of the two sides of the dental arch. The preceding definition of the dolichoid arch will at once show that long and short are but relative terms in relation to this classification; and that although we may get other varieties possessed of absolute qualities, yet the dolichoid jaw is only long in relation to its width, and not absolutely long in comparison with other jaws. In discussing the qualities of the triangle of the brachoid jaw, I shall have to refer to this again, in order

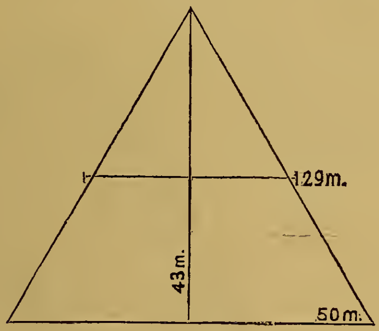

Fig. (10). Triangle of Dolichoid Jaw.

that the points of differentiation may be perfectly clear. Looked at from above, the dolichoid jaw presents the outline of an early English or Saxon window, with its circular top and parallel sides. Its special features are as follows: the small size of the dental arch occupied by the incisors and

canines; the straight line (more or less marked) on which the bicuspids and molars are implanted in the jaw, the higher plane of the vertex of the palate, and the well-nigh vertical direction indicated by the two lateral walls of the palate, in continuation of the alveolus of the bicuspids and molars.

2. Brachoid Jaw (Βραχὺς, *short*).

Definition.—A term applied to an upper jaw in which, with a less than average length from base

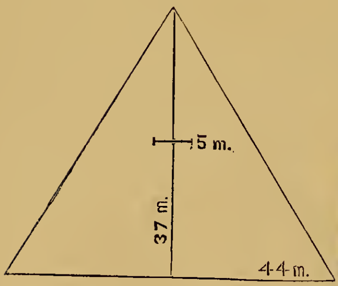

Fig. (11). Brachoid Triangle.

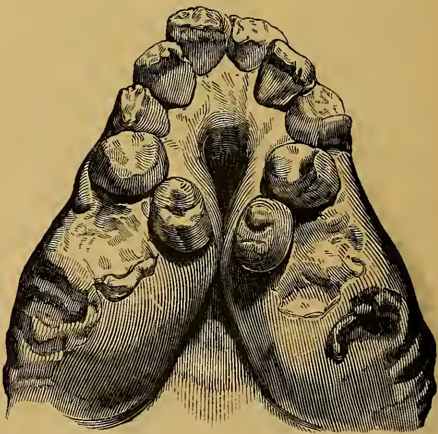

Fig. (12). Brachoid Jaw.

to apex of triangle, the interbicuspid line falls upon or within the sides of the triangle, or quite outside of the sides of the triangle. The above

definition shows that there are two varieties of short or brachoid jaws. In the one instance there may be a bending in of the arch in the bicuspid region to such an extent that, looked at from above, it presents the outline of two italic "*f*'s"

FIG. (13).
The same case after the four bicuspids were removed.

reversed, and almost meeting towards their centre; whilst in the other the bicuspids may be but little within the normal range, or even beyond it. In such a case the brachoid character of the jaw is due to the extreme frontal flattening in the region of the incisors and canines, and in some measure to bulging out of the bicuspids. The palatine surface will present a flattened arch, and

occasionally the palatine process of the one upper maxilla will be on somewhat higher plane than

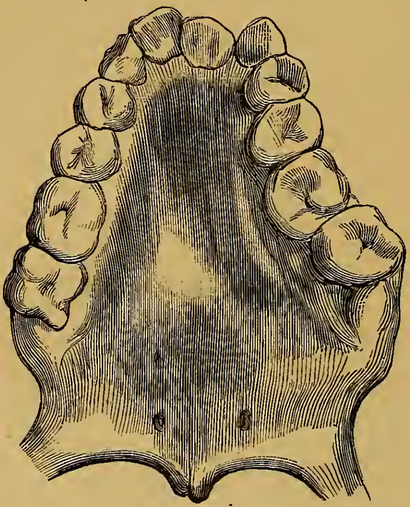

Fig. (14). Brachoid Jaw. Associated with a congenital cleft palate which has been closed by operation.

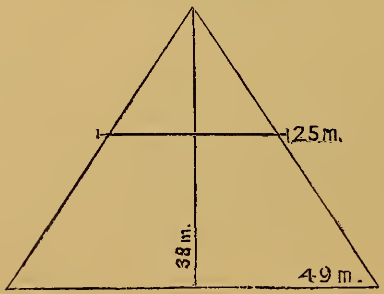

Fig. (15). Triangle of Brachoid Jaw.

the other. This may be seen by making a transverse section of the plaster model of the mouth;

or it may be observed, though less distinctly, by means of the tracing obtained from the leaden

FIG. (16). Brachoid Jaw.

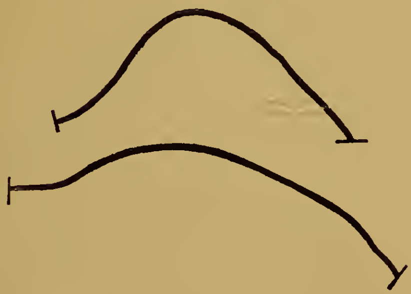

FIG. (17). Palatine outlines, taken transversely and longitudinally.

rule, as shown in the accompanying engravings. Under the classification "brachoid" would be included most of those cases that we now find

described as contracted maxillæ. It may at first appear as if there were very little difference

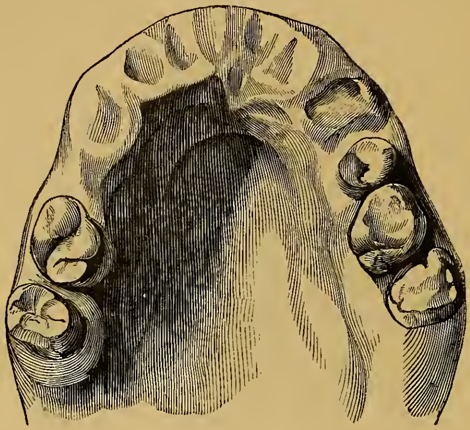

Fig. (18).

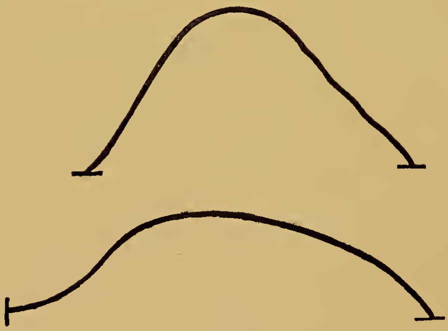

Fig. (19).

Figs. (16) and (18) are engravings of the mouths of two brothers, both somewhat deficient in intellect, and with very defective articulation. It will be seen by the tracings, Figs. (17) and (19), that the palates are asymmetrical, and wanting in the degree of antero-posterior curvature.

between the dolichoid and the brachoid jaw; but closer observation will show that there is a very marked distinction.

Thus, whatever the length of the dolichoid jaw, the interbicuspid line will not fall within the triangle, whilst with the brachoid jaw it may fall anywhere within the triangle — unless, indeed, owing to extreme shortness and breadth of arch, the line falls very much beyond the triangle. Again, it will be observed that whilst the dolichoid antero-posterior measurement is but little if any less than an average arch, the brachoid arch gives a similar line very much below the average.

3. Macroid Jaw (Μακρὸς, *large*).

Definition.—A term applied to an upper jaw in which the measurements of the arch, though relatively to each other normal, are yet absolutely greater than the average standard, the palate, moreover, being the seat of well-marked deformity. The true macroid jaw is comparatively rare, and is invariably found associated with some other abnormality. Beyond its size, it presents but few points of interest, the palate chiefly claiming attention on account of its extreme vaulting. The dental arch is well formed, and the teeth regular, but not large as compared with the

general dimensions of the mouth. The most notable example that I have met with as illustrating

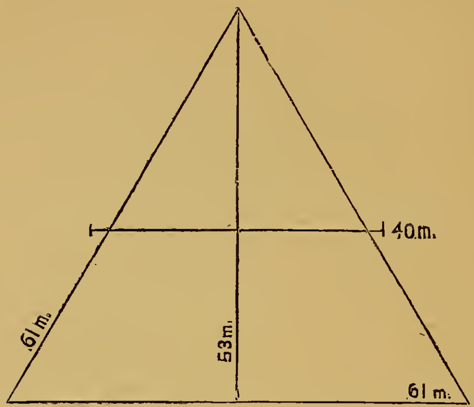

FIG. (20). Triangle of Julia Pastrana's Jaw.

FIG. (21). Macroid Jaw.

the special features of the macroid class, is the

case of Julia Pastrana, in which the base of the triangle gives a measurement of 61 m., whilst the interbicuspid lines reach the extraordinary length of 40 m. or 5 m. beyond the normal standard. My model is unfortunately not sufficiently perfect for me to take the palatine outlines.

4. Microid Jaw (Μικρὸς, *small*).

Definition.—A term applied to an upper jaw in which all the measurements are below the average standard.

But few words beyond those contained in the

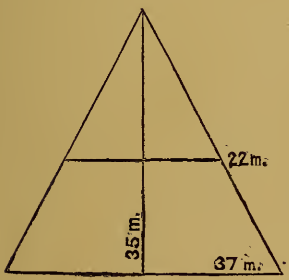

Fig. (22). Triangle of Microid Jaw.

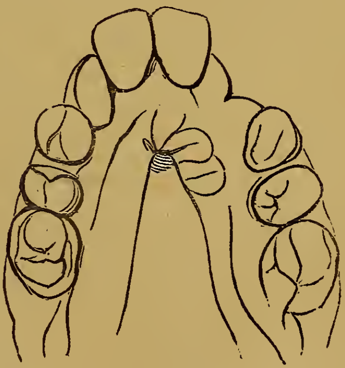

Fig. (33). Microid Jaw.

foregoing definition are requisite to describe the microid jaw. It is an ordinary upper dental arch, only very much in miniature, properly propor-

tioned, and with fairly developed teeth, the palate deep apparently, but not really. There may be a small amount of lateral contraction, but not sufficient to destroy the symmetry of the arch.

Some idea of the size may be gained from the statement that in one case that I have measured (the patient being thirty-seven years old), the base line was only 37 m. as against 61 m. of the macroid, and the interbicuspid line only 22 m. long as against 40 m. of the macroid.

5. Intermaxillary Prognathism (Πρὸ, *before;* Γνάθος,, the *cheek* or *jaw*).

Definition.—A term applied to an upper jaw, in which the dental triangle having been taken,

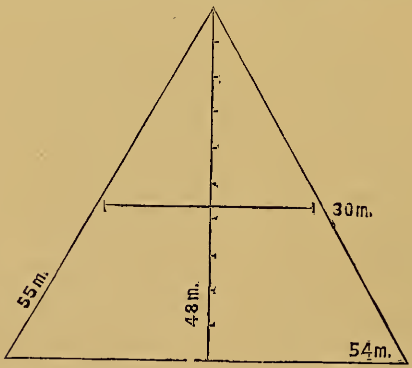

Fig. (24). Triangle of Intermaxillary Prognathous Jaw.

the distance from the interbicuspid line to the apex of the triangle is greater than the normal

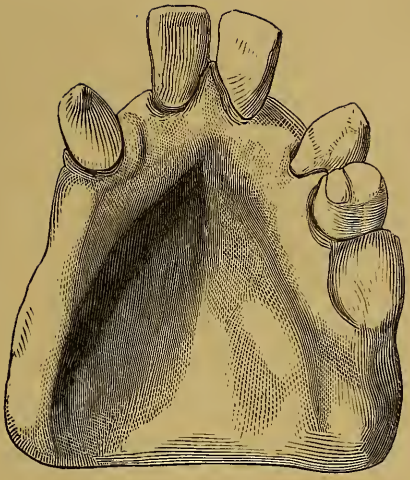

Fig. (25). Intermaxillary Prognathous Jaw.

Several of the children of this patient exhibit the same strongly marked prognathism.

Fig. (26). Intermaxillary Prognathous Jaw.

The brother and nieces of this patient exhibit in the most pronounced way the same marked prognathism.

standard, and also greater than the distance from the interbicuspid line to the base of the triangle, to which it should normally be nearly equal. Thus, in a triangle having its vertical line divided decimally, the interbicuspid line falls a little over four-tenths from the base, giving six-tenths for the distance from the intercuspid line to the apex of the triangle.

The term prognathous is applied in anthropology to those skulls in which the projection of the upper jaw is excessive, and is accepted as a race-characteristic. "All races, all individuals, are prognathous, the difference between them being only in degree: the natives of Europe, notably the Gauls, being least so, and the pure Hottentots reaching the highest maximum of the whole human race."*

M. Topinard recognizes as true prognathism that which he calls alveolo-sub-nasal, limiting its area "to the portion of the maxilla subjacent to the nasal spine, which corresponds to the palatine arch, and that next to it in which the alveoli are situated."†

Applying the term to the purposes of a pathological classification, I have deemed it wise to limit still more the area to which it shall refer;

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* Topinard, "Anthropology," p. 282. English Ed. 1878.

† Topinard, "Op. cit.," p. 281.

hence the prefix, intermaxillary-prognathism. Still more shall I endeavour to justify the use of this prefix by arguing, further on, that the intermaxillary bone is an important factor in the production of the deformity. Briefly to describe a case: we find an elongated jaw with a small arch in the incisive region, with the molars and bicuspids implanted nearly in a straight line, and but slightly divergent on either side from the central line of the palate. The bicuspids and molars appear but a moderate distance through the alveoli, and the incisors and canines will be found separated from each other by a varying amount of space, according to the age of the patient, the eversion of the teeth in late middle life being increased by mechanical causes operating on their primary displacement.

The alveolar arch will be observed in front as projecting abnormally, and retaining its marginal peculiarities, an important point to notice, as it enables us to diagnose with other symptoms between the prominent teeth of the thumb or tongue-sucker and the case of true congenital intermaxillary prognathism.

It might at first be supposed that the alteration in form was due to great lengthening of the jaw backwards, and projection of the teeth only, and that the prognathism of these cases was apparent rather than real; but exact measurements from

the triangle show that a typical case gives a remarkable resemblance between this malformed English jaw and a typically-developed Hottentot's jaw, the interbicuspid line in the abnormal arch falling a little over four-tenths from the base line, and in the Hottentot's* jaw falling exactly four-

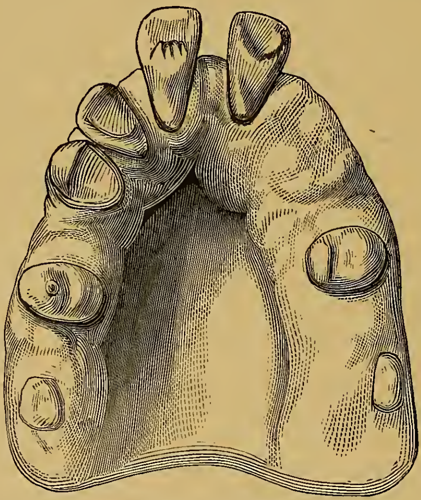

Fig. (27). Exhibits an example of thumb sucking, and is shown here in order to point out the liability to error in diagnosing between this condition and that of intermaxillary prognathism.

tenths from the base, thereby showing not only the similarity between the two, but also indicating

* There is also curiously enough the same degree of prognathism to be seen in the skulls of two Anthropoid apes in the Museum of the Odontological Society (Nos. 10 and 11). The skull of a Chinaman (Anatomical series, No. 8) also gives the interbicuspid line falling upon the triangle four-tenths from the base.

the region in which the departure takes place from the normal English arch. As the posterior division corresponds, so we find the anterior measurements from the interbicuspid line to the apex of the triangle very nearly the same, that is, nearly six-tenths for the intermaxillary prognathism, and fully six-tenths for the prognathous Hottentot.

The palatine arch does not call for any special description, as it displays no unusual features.

6. Intermaxillary Hypognathism (Ὑπὸ, *deficient, less than ;* Γνάθος, the *cheek* or *jaw*).

Definition.—A term applied to an upper jaw in which, the dental triangle having been taken, the

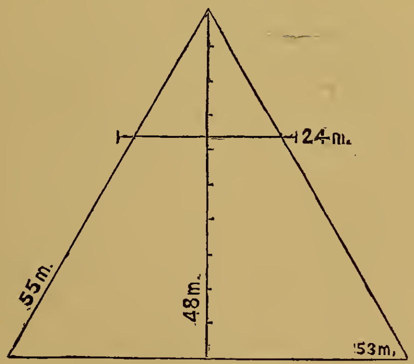

Fig. (28). Triangle of Intermaxillary Hypognathous Jaw.

interbicuspid line will fall far in advance of the

normal distance from the base of the triangle, the four incisor teeth being crowded together, and

FIG. (29). Intermaxillary Hypognathous Jaw.

FIG. (30). Intermaxillary Hypognathous Jaw.

the canines, by reason of the smallness of the anterior section of the arch, kept out of their

normal position. The dimensions of the case of hypognathism that I have chosen for the purpose of description gives a base, and sides of the triangle, almost identical with that obtained from the prognathous jaw described in the last section. The points of difference will, therefore, be more readily appreciated, as the decimal measurements from base to apex are the same.

The hypognathous jaw is one in which we find the bicuspids and molars occupying a fairly normal position, but the centrals very close together, and the lateral incisors almost immediately posterior to them, the canines standing outside the arch and in part filling up the gap between the bicuspids and central incisors. The vaulting of the palate is considerable, its lateral walls approaching the vertical, whilst its antero-posterior outline gives an index of the depth of the alveoli and the abruptness of the curve. All the characteristics are probably exaggerated in the present case, on account of the large size of the teeth, and the very pronounced development of their investing alveoli. Yet, making allowance for these sources of error in estimation, sufficient remains to enable us to obtain adequate data for the purposes of the present classification.

Referring then to this typical triangle we find that whilst in the intermaxillary prognathous jaw we obtained an interbicuspid line falling a little

over four-tenths from the base line; in the inter-maxillary hypognathous jaw we have the inter-bicuspid line falling rather more than six-tenths from the base line. Or, putting the case the other way, we have in the prognathous jaw the apex six-tenths in advance of the interbicuspid line, whilst in the hypognathous jaw we have it only a little less than four-tenths, thereby showing the excessive development with interdental spacing in the one, and the diminished development and interdental crowding in the other; whilst the interbicuspid measurement (only 24 m.) shows the contraction of the arch owing to the diminished size of the intermaxillary region.

7. Lambdoid Jaw (Λ, *lambda*).

Definition.—A term applied to an upper jaw in which the outline of the dental arch and the sections of the palate resemble the form of the Greek letter *lambda* and present a wedge-like appearance.

Under the name of V-shaped arch we have hitherto included those cases of deformity of the upper jaw that are regarded as being specially associated with a very low mental development, whilst, as I have shown in an earlier part of this paper, the term was allowed to include a number

of conditions that the name did not in all cases indicate or fairly represent.

In the six classes of abnormal jaws already described, I have included, under a precise name, most of those that have been hitherto referred to under the more general term of V-shaped, but we still have one very pronounced form of abnormality that requires a special description. If the jaw were looked at upside down the term V-shaped would properly describe it, but looked at in the ordinary way it corresponds in outline with the Greek *lambda*, and hence I propose the adoption of this name, first, as being diagramatically more appropriate; and, secondly, from its Greek origin offering greater uniformity with the titles of the first six classes enumerated. I have intentionally left the description of the lambdoid jaw till the last, as, whilst all the other classes have their parallels in normal jaws, in form if not in degree, the lambdoid jaw is a class alone, without normal parallel, and doubtless the product of profound central lesions during early embryonic life.

The outline it presents I have already mentioned; beyond this we have to note the large size of the teeth, the prominent markings of the mucous membrane, and the diminished interbicuspid measurement,—thus, in a typical case we have a base line of 56 m., a length of 43 m. from base to apex

of triangle, and an interbicuspid measurement of only 28 m., falling within the sides of the tri-

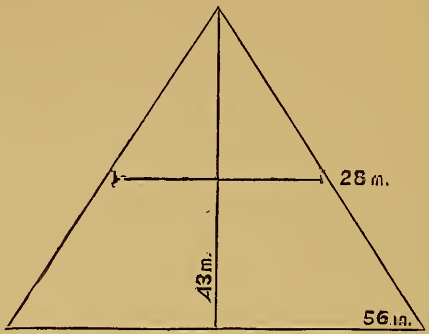

Fig. (31). Triangle of Lambdoid Jaw.

angle; the central and lateral incisors semi-rotated, and the palate presenting the typical

Fig. (32). Lambdoid Jaw.

wedge-shaped outline, the vertex being above the normal plane, and the soft palate too short to

touch the posterior wall of the pharynx. Although it is not essential to idiocy that this deformity should exist, still it is tolerably certain that the lambdoid arch is rarely seen except in connection with low mental development, and especially where the idiot is microcephalic.

Without entering upon the much-vexed question of the proofs of congenital idiocy, it may yet be well to say that such cases rarely, if ever, occur without showing some deformity of the jaw, if sufficiently accurate dental observations be made to ascertain the fact.

Having thus endeavoured to justify the expediency of the present classification I will, as briefly as possible, attempt to give an explanation of the origin of those lesions to the enumeration of which I have devoted this chapter, stating at once, however, that whilst hitherto I have confined myself as strictly as possible to a bare recital of observable facts, my remarks will now be of a more or less speculative character.

I must confess I am unable to explain at present the origin of the Dolichoid and Brachoid jaws. The investigations that I am still carrying on will possibly at some future time enable me to throw light upon the subject, but as yet my views are not sufficiently definite to be of any value. It would be easy to say the changes in form are due to premature synostosis; that would doubt-

less give a well-known name to the process, but it would not at all explain the origin of the process, or why the ossification should take place in one direction rather than another. The whole of this question, as with the macroid and microid jaws, bears an intimate relationship to general cranial morphology, and for that reason I must defer any attempted explanation of the origin of a set of deformities, in connection with which we can at present deal only with processes and results, and not with original causes.

In regard to the prognathous and hypognathous jaws, we are in a somewhat more satisfactory position, and although I would not assume to speak with authority, yet I trust I may be able to put forward a case with such a show of reason as shall at least command further and patient investigation.

My first assertion is this, that the deformity known as *intermaxillary prognathism* is the result of a force operating on the intermaxillary bone, such force originating in the body* of the sphenoid, and being transmitted by the intervening

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* It may be urged that too much importance is attached to the influence of the sphenoid, but it must be borne in mind that this bone continues to grow up to about 25 years of age, and sometimes remains un-united with the occipital bone up to 30 years of age. This will in part explain the fact of deformities of the upper jaw appearing after the eruption and shedding of the temporary teeth, and becoming intensified towards adult life.

nasal septum. (I may at once say that when speaking of *force* I mean a direction of growth in a given line of such energy as to overcome the resistance offered to it by surrounding structures.)

The foregoing assertion is based upon the interpretation of the following observed facts :— First, the true case of intermaxillary prognathism will have a long thin nose. Secondly, this long thin nose is not observable during the first dentition, nor is the prognathism, excepting to a very slight degree indeed. Hence we may conclude that the long thin nose and prognathous jaw are capable of intensification by growth and development during early life. Thirdly, it has been shown that the measurement from the inter-bicuspid line to the incisive angle is greater in the prognathous than in the normal jaw : hence it follows that the change from the normal arch occurs at a point anterior to the second bicuspids, whilst the second bicuspids are known to correspond with the position of the second molars of the milk dentition. Thus it is shown that the prognathism is not of the whole jaw carried forward on a horizontal plane, but is really intermaxillary or alveolo-sub-nasal in its character.*

* It will be interesting, in connection with this part of the subject, to refer to some particulars of the "Aztecs," a man and woman exhibited in London and Paris some years ago. "The man was 32 years of age and 1·35 mètre in height, the woman was 29 years of

Fourthly, it is a simple logical sequence of the process that produces intermaxillary prognathism, carried a step further during embryonic life, that produces double hare-lip and fissured alveolus. The specimens in the Royal College of Surgeons and the illustrations in our standard works on surgery, as well as the plates published by Von Ammon and Vrolik,* amply prove that in double hare-lip the intermaxillary bone is carried forward by the vomer and the rest of the nasal septum; and in many cases we know this is removed by the surgeon in operating for hare-lip, and we obtain afterwards the† grooved centre to the alveolus, with two canines or occasionally a lateral incisor, one on either side of the termination of the true maxillary process.

Arguing back from these cases of double hare-lip to pre-maxillary prognathism, we can come to no other conclusion than that the duration and

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age and 1·32 mètre. Their intellectual capacity was scarcely that of a child of three years of age; their language consisted of fifteen words, which they uttered in jerks. As a result of the defective development of the brain there is smallness of the cranium, especially in the frontal region. The facial region which grows regularly, at least more so than the cranium, appears large. The eyeballs, in consequence of the atrophy of the forehead, project above and are slightly hidden under the lower lid. *The nose, at least in these two cases*, is very projecting. *They are very prognathous*, their lower jaw is smaller than the upper, so that the alveolar arch recedes about 25 millimètres." —Topinard, *op. cit.*, page 166.

* See illustrations of cases, plate (6), Figs. (6 and 7).

† See illustrations of cases, plate (13), Fig. (33).

extent of the force operating upon the intermaxillary bone determines the nature and extent of the deformity that will be produced. I shall doubtless be met with the assertion that as the prognathism is not pronounced in early life, and as the union of the intermaxillary bones with the true maxillary bones is complete at this time, therefore it is impossible that the intermaxillary bone can be the subject of any subsequent change. Against this objection, I may say that as I have shown that intermaxillary prognathism is but a preliminary step in the deterioration of form that will produce in a subsequent generation (subjected to like conditions of propagation) double hare-lip, so we may assume that the general cranial development will in the two cases bear some relation to each other; and that as we know (on the authority of Hutchinson) that in cleft-palate cases ossification of the sutures is delayed to a period far beyond the usual date, so in cases of intermaxillary prognathism the sutures would not be so much ossified as to oppose any sufficient resistance to the exercise of the force originating in the sphenoid,—a force that I at first asserted was the cause of the prognathism. From collateral evidence we know that many cases of prognathism are associated with such central lesions as will manifest themselves in the form of idiocy or imbecility; and further, that

the general configuration of the face is ape-like, from its diminished facial angle and retreating chin; and we also know that in the apes the intermaxillary suture is not ossified till late in life, nor is the prognathism developed till after the primary dentition. Still further, we have it on the authority of Topinard that the skulls of the Merovingian race are the most prognathous of any found in France; and next we have it on the authority of French historians that the Merovingian dynasty was so debased in physical and mental development as to be known in their latter days as *les rois fainéants*. It will, therefore, scarcely be straining the argument unduly if we assume that as man by deterioration returns to the type of the higher apes; so, by the like process, he will in his method of development be subjected to similar conditions of growth and ossification. I do not, of course, wish it to be understood that all who have intermaxillary prognathism must of necessity be either idiots or imbeciles; but I desire very distinctly to assert that such a deformity occurring amongst the highly civilized is a distinct mark of deterioration of stock, whilst it is differentiated from the normal prognathism of the Hottentots by the diminished interbicuspid measurement of the dental arch of the highly-bred European.

Intermaxillary hypognathism is not so easily

to be accounted for. It occurs in the offspring of the apparently robust; but I think more extended observation will probably show that there is a scrofulous tendency on one or both sides of the ancestral tree, not that we have any very pronounced symptoms, but judging from the liability of the patient to certain diseases.

Thus we shall often find fragile nails, delicate hair, clear complexion, great physical beauty, combined with a constant tendency to disease of the tonsils, general relaxation of the mucous membrane, disease of the joints, and liability to phthisis. The facial angle will be good, and the chin pronounced in character, the lips will rarely be shut, thereby indicating the post nasal interference with respiration, and the nose will be either symmetrically small or "tip-tilted." Looking at the face as a whole, we should say that the nose was too small and the lips were too short, or that the rest of the face was too large for these two features. It really is the nose and mouth that are too small, and as we saw in the prognathous class deformity due to excessive development in this region, so we see in the present case deformity due to deficient development.

As to the primary cause of either the one or the other, we are comparatively in the dark. It must not, however, be overlooked, that as we

have seen the influence of the growth of the sphenoid in connection with pre-maxillary prognathism, so we must not disregard the results likely to ensue from an arrest of growth of the sphenoid in cases of pre-maxillary hypognathism. More especially as we find the flat arch of the brachoid jaw associated with inherited syphilis and the crowded arch of the hypognathous jaw occurring in the subjects of well marked Rickets.* Under both of these pathological conditions there is more or less marked arrest of development in the skull, whilst in the true cretinoid skull there is pronounced premature synostosis of the basi-occipital and basi-sphenoid. From the sociological point of view, hypognathism is not such a serious matter as prognathism, for I have endeavoured to show that the latter indicates a deterioration of stock that is in all probability progressive, whilst the other arises from a robust stock subjected to certain unfavourable influences that may from their nature be sooner or later eradicated.

The Lambdoid jaw, or V-shaped arch, as it has hitherto been called, seems to combine most of the features of deterioration that I have taken as

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* Additional interest has arisen in connection with this subject on account of the recent discussion at the Pathological Society of London on Rickets. (See "Brit. Med. Journal," December, 1880.)

* "Bristowe's Practice of Medicine," 1876. Page 897.

class distinctions in the other varieties. Thus the triangle is somewhat below the average from base to apex; the base is beyond the proportionate length; the interbicuspid line falls within the triangle; and the general appearance of the front of the mouth is prognathous. This last condition is not, however, real, but simply apparent, owing to the peculiar arrangement of the teeth in their sockets, and not owing either to local or general prognathism of the jaw.

Although there is little question that all the other forms of jaw that I have described may be, and probably are, found in connection with congenital idiocy, yet it seems probable that this lambdoid jaw is connected with the most pronounced type of idiocy, namely, the microcephalic.

After carefully examining the works of various writers on the subject of microcephalic idiocy, there seems sufficient evidence to justify the belief that premature ossification of the sutures is the rule in the majority of these cases; and we may, therefore, assume, if we cannot absolutely conclude, that this influence operates powerfully in the production of the dental deformity known as the lambdoid jaw; and this view is held by Professor Virchow, but it is combated by Dr. Langdon Down and Dr. Ireland.

CHAPTER VI.

PALATE AND CRANIUM.

Since November, 1869, I have made a series of observations on the correlation between the palate and the cranium, especially in connection with their transverse and antero-posterior outlines, and also with regard to the outline and length of the alveolar arch. My tracings of the dry bones have been made with strips of lead applied accurately to the parts to be outlined. My investigations on the living subjects have been carried out by means of an instrument that I had constructed for the purpose. It consisted of a half-circle of vulcanized India rubber, perforated at fixed intervals and having small brass tubes, two inches long, accurately fitted to the perforations, so as to be capable of adjustment to the cranium and giving its outline at points nearly approaching to each other.

By the use of this instrument the irregularity of outline produced by masses of hair (if a continuous flexible band had been applied), was avoided. The curves of the palate and alveolar arch were obtained from models taken from the

mouth, in wax or some other plastic material. The outlines of the cranium were taken longitudinally from the glabella to the occipital protuberance, and transversely from the anterior margin of the external meatus on either side. The palate was outlined on the plaster of Paris cast from between the incisor teeth on their lingual aspect, to the extent of the model—that is to a point nearly corresponding with the posterior margin of the palatine process of the palate bone. The transverse outline was taken between the second bicuspid tooth on either side, traversing the vault of the palate.

In the normal and fully developed skull there seems to be some relation between the transverse and longitudinal curves of the palate and the corresponding lines of the external surface of the cranium, taken in the directions indicated. Examples of this correspondence in form, if not correlation of development, may be seen in plates, marked "Greek," "Chinese," and the two following uninitialed diagrams. Dr. Claye Shaw* has also observed "that there is a general relation between the shape of the palate and that of the skull as to length and breadth."

In the examination of over five thousand patients taken from all classes, and of all ages,

* "On the Measurement of the Palate," *Journal of Mental Science*, July, 1876, p. 200.

I have met with but two well marked examples of the effect of premature ossification of the sutures of the upper jaw and the bones of the anterior part of the skull. One of these may be seen in plate L.W. The subjects were both above the average in intellectual activity and capacity, and it will be observed that the jaw of the subject engraved (Fig. 33)* is the size of that of a child nine or ten years old, whilst the circumferential outline of the skull (taken at the level of the supra orbital ridge and the external occipital protuberance), indicates the points at which the bones have yielded to the growing brain. In patients who have fissured alveolus and palate, it is impossible to establish any correlation between the upper maxilla and the skull, but the curious fact may be observed, that by taking the horizontal circumference (as just described) there will be found, apparently proportionate to the degree of intelligence of the patient, a flattening of the anterior half of the skull, occurring chiefly on the left side and at a point corresponding with the region of Broca's convolution.

Thus, I have observed that those with the greatest flattening, are the least capable in the faculty of producing articulate sound, whilst their general intelligence may be low, as indicated

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* See page 73.

by the nature of their occupation. This flattening in the anterior parietal region may be found also in cases of defective intellect and imperfect articulation without any palatal deformity sufficient to account for the defective articulation, though the palate may not reach absolutely the normal standard. This asymmetry is sometimes general throughout the skull and not confined merely to the cranial bones; thus in the more severe cases the lower jaw is diminished in size on one side, and the left ear is occasionally the seat of well marked arrest of development, whilst the level of the orbits will vary and the malar bone occupy a higher plane on the left side than the right. In such a case the hearing is generally imperfect, and the intellectual powers are below the average, the tongue and fauces are wanting in sensibility, and all the receptive faculties are deficient.

In some patients of a high degree of intelligence, there is a notable inability to distinguish the quality of the sounds they may themselves produce, whilst in others this faculty is quite acute. My first impression was that the symptoms to which I have called attention were the result of physical defects of the palate and injury to the brain, conveyed by mechanical forces, operating through the brain-case. I therefore submitted the following statement with a possible hypo-

thesis to my friend, Dr. Ferrier in January, 1879.

"Nearly all defective palates, in so far as speech is affected, are associated with flattening of the left side of the cranium."*

"Speech is most defective in cases of cleft palate associated with single or double harelip."

"In these cases there is abnormal approximation of the two upper maxillary bones; owing partly to diminished size of intermaxillary bone, but chiefly to the contraction caused by healing of wound after the operation for harelip has been performed."

The flattening of the left side of the head may be due—

1. To pressure of the fœtus in utero against the sacrum.†
2. To the influence exerted on the growth of the bones by the healing of the wound already referred to.

"Aphasia is known to be due 'to disease occur-

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* This statement is based upon the observations of Dr. Langdon Down and the author.

† This pressure is exerted during parturition and is well known as a cause of parietal flattening; see Transactions of the Obstetrical Society of London, Feb., 1881. "Two cases of parietal indentation in contracted brim of pelvis from pressure upon the promontory of sacrum."

ring in the region of the posterior extremity of the third left frontal convolution, at a point corresponding with the situation of the motor centres of articulation in the monkey.' "*

Is the compression of the brain in this region, as indicated by the flattening of the cranium, likely to disturb the development of the function of speech? and, if so, might one predict—from the shape of the head of a cleft palate patient—the probable value of any operative or mechanical interference with the mouth, in order to the production of the physical conditions essential to speech?

Dr. Ferrier's reply was as follows:—

"16, UPPER BERKELEY STREET,
"PORTMAN SQUARE, W.
"*February* 1*st*, 1879.

"MY DEAR OAKLEY COLES,

"The problem you have placed before me is an extremely interesting one, but I must confess to having been ignorant of the curious collection of facts stated by yourself and Langdon Down in the first paragraph.

"I presume you mean true aphasic defect, as distinct from mere defect in articulation, *i.e.*, deficiency in the power of acquiring and using articulate speech.

"These defects in articulation may have many causes, and of course will be seen in hare-lip, &c., but true

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* Functions of the Brain."—FERRIER. p. 272.

aphasia is purely a matter of cortical deficiency of some kind. Now if there is real aphasic defect in the cases of cleft palate you mention, the presumption is that there is defective development of the speech centre, and in all probability on the left side. But mere flattening of the skull on the left side cannot be taken by itself as proof of cortical deficiency. The skull may be merely distorted, and the brain with it, but the brain need not be defective. We know how some Indian tribes distort the skull and brain by pressure, and we see in the flat fishes an enormous distortion of the brain with the skull (as in the flounder, plaice, &c.)

"It is possible, on the other hand, that flattening of the left side of the skull may signify defective development of the left side of the brain. Unless, however, you can actually show defective development of the brain, or actual pressure on it, you have no right to assume any such relationship from mere flattening of the left side of the skull.

"Next as to the cause of the flattening. I must say, in reference to your first supposition, that I have a deeply rooted mistrust in mechanical explanations. What reason have you for supposing that the left side of the head of a fœtus with defective palate is more likely to be pressed upon than a normal fœtus? Have you any statistics as to the relative frequency of flatness of the left side of the head apart from cleft palate? As far as I know the hypothesis of pressure against the sacrum is purely gratuitous, and anything but satisfactory.

"From your second suggestion* I gather that you

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* The flattening may also be seen in those cases in which there is no hare-lip. See p. 97.

have only examined cases in which the cleft palate had been operated on and healed. But it is obviously necessary, before arriving at any conclusion as to the flattening of the left side of the head, to ascertain whether it exists before the cleft palate has been operated on. Though I can only speculate, as I do not know the facts, my belief is you will find it existing at birth. If so your second hypothesis will not require further consideration.

"But I am strongly of opinion that you will find flattening of the left side of the head and cleft palate to be the conjoint expressions of a defective development, and that neither is to be explained by the other, and that no mechanical explanations are of any value whatever.

"But, assuming it proved that with defective palate there is defective development of the speech centre, you ask whether operative interference will have any influence on the faculty of speech. I think it will improve articulation, but it can have very little influence on the language capacity. I do not say no influence, for if by an operation you render articulation more easy, you will thereby react favourably on the centres of articulation, and perhaps further their development. This, however, can be but to a very limited extent.

"Such are my speculations on the questions you have set before me. If you think them of any value to you, please make any use of them you think fit.

"Yours very truly,

"DAVID FERRIER."

Dr. Ferrier's reply naturally invested the subject with a greater interest even than before

attached to it. I am not, however, prepared to accept Dr. Ferrier's explanations entirely, as I believe the causes assigned for the flattening of the left side of the cranium have sufficient evidence to support them as contributing to, though not as originating the condition we are discussing; but I accept almost without reserve the conclusion that asymmetry of the cranium and cleft palate are both "the conjoint expressions of a defective development, and that neither is to be explained by the other," still they are emphasized in their expression by the mechanical influences to which I have drawn attention. It may at once be stated that no skull is ever perfectly symmetrical,* asymmetry therefore, becomes simply a question of degree. It has been pointed out by Dr. Crochley Clapham, of the West Riding Asylum, and Dr. Henry Clark, of the West Riding Prison,† that 81·771 per cent. of the insane were "left headed," 25 per cent. of the imbeciles were symmetrical, whilst amongst the criminals "the right half of the skull was almost invariably in advance of the

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* "The most frequent irregularity in the form of skull is want of symmetry. This sometimes occurs in a marked degree, and there is probably no skull perfectly symmetrical. The condition which has been observed to co-exist most frequently with irregular forms of skull is synostosis or premature ossification of certain of the sutures." —Quain's "Anatomy," eighth edition. 1876. Vol. i., p. 80.

† "The Cranial outline of the Insane and Criminal." West Riding Lunatic Asylum Medical Reports, 1876. Vol. vi., p. 154.

left half, the whole side appearing to be pushed bodily forwards, and both its frontal and occipital limits placed anterior to those of the opposite side."

Dr. J. S. Wright says* "there is a pretty constant asymmetry of the brain and its bone case. And what is most remarkable, the asymmetry itself is not uniform. No two heads† are exactly alike."

It is, however, in the more severe cases of congenital deformity, that we shall find these points best shown. Thus Dr. Ogston‡ quoting from Vrolik's cases of congenital smallness of the lower jaw, observes that the asymmetry of the cranium is shown to be present in the plate published, although Vrolik disregards the fact and explains the peculiarities of the skull as "dependent on each other, and having one common cause, viz: the congenital shortness of the lower jaw." Dr. Ogston however, inclines to the belief that "the want of symmetry of the cranium is found in other cases to be a usual accompaniment of malformations of the lower jaw, and seems in Vrolik's

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* "Some Measurements of the Skull." Proceedings of the Medical Society of the County of Kings, United States. April, 1878, page 74.

† These were normally developed skulls of various nationalities.

‡ Congenital Malformations of the Lower Jaw, "Glasgow Medical Journal," July, 1874.

case to have been coetaneous with the deformity of the jaw, rather than to have been produced by it." In cases of unilateral smallness of the lower jaw,* there is diminution in size on the corresponding side of the cranium, and also in the teeth of both lower and upper jaw, and I have just noted the asymmetrical condition of the cranium in the subjects of bilateral smallness of the lower jaw.

These malformations are very rare, and until the literature of the subject had been collected by Dr. Ogston, but little was known in reference to them. My object at present is to show the connection between such abnormalities in the maxillary region and the asymmetry of the cranium, rather than to discuss the individual cases recorded by that author.

Still bearing upon the subject of asymmetry of the skull, a most notable example may be quoted of Dr. Schroeder van der Kolk's.†

"A boy, aged fifteen, had an inequality of the skull, as if the left half of the brain was cut off from above towards the ear, and was covered with a flat bone, so that the size of the left hemisphere could certainly not amount to more

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* Ogston, *op. cit.*

† "Damerow's Algem. Zeitschrift für Psychiatrie." Berlin, 1851, 8 b. 2 h. p. 279. (Ireland, Idiocy and Imbecility. London, 1877, p. 160).

than one third of that of the right, at the same time he had a tottering gait without being paralyzed. This boy, who at first appeared to be quite idiotic, and incapable of learning or understanding anything, had, under constant instruction, three years later grown into a strong lad, and his intellectual faculties were fully developed, while his brain was increasing in size, the left hemisphere, however, always continuing about one-third less than the right."

Unfortunately, this report gives no record of the remaining physical features of the patient. It is to be regretted that in most of the records of congenital idiocy, although the dimensions of the skull are given transversely and antero-posteriorly, the diagonal measurements are rarely noted; it is only in isolated cases, therefore, that I can give any information on this point.

Mr. Carver (quoted by Ireland) has given such particulars* in reference to the body of an idiot that he was able to examine, and he states that "the oblique diameter from the left side of the occipital bone to the right side of the frontal bone was long, at the expense of the opposite diameter."

Another instance is recorded by Dr. Ireland†

* "Journal of Anatomy and Physiology," May, 1869.
† Op. Cit. p. 54.

as occurring in the case of a "Kalmuc"* idiot, forty years old. The intellect was equal to that of a child of a year old, and she *could not speak.* The skull was very light, and asymmetrical. The internal fossæ were unequal. The sutures were remarkably open, the frontal being still persistent. The brain, weighing 40 oz., was healthy in structure, but the configuration was asymmetrical. There was bulging in the right frontal and left parietal regions, and slight flattening in the left frontal and right parietal lobes, with asymmetrical form in the covering bones. The horizontal plate of the palate bone was not arched. The lower jaw had the obtuse angle found in connection with an edentulous condition, and the nasal bones were absent.

Dr. Ireland, whilst observing that asymmetries of the base of the brain are not unfrequent with genetous idiots, still regards them as evidence of a disordered direction of formative power, rather than as explaining the mental hebetude. As regards the probable origin of asymmetry of the cranium, some interesting observations have been made by Dr. Stadfeldt†, who states that

* This variety of idiocy has been described under the name of the Mongolian type. See London Hospital Reports, Vol., II., "Ethnic Classification of Idiocy," by Dr. Langdon Down.

† "On the Asymmetry of the Body of the Human Skeleton." Translated from the "Bibliothek for Lœger." 5 Række, 8 Bind. April, 1864. By William Moore, M.D., Dublin, and published in the *Dublin Quarterly Medical Journal*, August, 1864.

whilst making some measurements of infants' heads, he found this want of symmetry was scarcely ever absent, and that it was often very considerable. Dr. Stadfeldt convinced himself that it was not due to mechanical forces operating in the process of parturition, as in certain cases he found the same conditions with the fœtus and uterus in *situ* where delivery had not occurred, and it was also seen in a six months' fœtus. The reader must refer to the original paper for a complete account of these researches, but it will be convenient to give here Dr. Stadfeldt's hypothesis in his own words.

"I am obliged to go far back into fœtal life, in fact to the oscillations of the embryo in the ovum in the first weeks of its development. It is well known that the fœtus, after the first few weeks, exhibits a rotation around its longitudinal axis, so that its central part forms an elongated spiral from the left to the right side; during a certain period of fœtal life this is very well marked; subsequently it somewhat disappears, but the trace of it can still long be found, and I have met with nothing to overthrow the hypothesis, that the *scoliosis pervading the whole body of the skeleton is a remnant of the spiral rotation of the embryo in the ovum.* On the contrary, this cause of the scoliosis in the skeleton, will explain many peculiarities. By it we shall be able to

understand why the scoliosis is most distinctly visible at the base of the skull, and on the anterior surface of the vertebral column, because these parts, during development, are the first to acquire a firmer cartilaginous consistence, while the arches of the vertebræ, and especially the arch of the skull, have a more persistent fibrous condition, and, therefore, during ossification, are more liable to modifications in their original form."

Under the name of Paralytic Idiocy, Dr. Ireland quotes some very interesting cases of inability to pronounce certain sounds or letters, and in nearly all of these cases there was flattening of the left side of the cranium. Dr. Ireland regards it as immaterial to this classification whether the paralysis was ante-natal or post-natal. Our chief concern at present is to show that certain distinct functional defects are coincident with definite physical conditions.* In connection with the views of Broca, which are generally accepted, it has been pointed out that there are two distinct divisions of the faculty of language, first, the general, and secondly, the articulate language faculty. When the latter is the seat of any lesion, the patient, although he may have a

* It may be noted here that in cases of flattening of the cranium on one side, there may be seen occasionally shortening of the arm on the opposite side of the body.

definite conception of certain symbols expressive of a given idea, is still incapable of putting the mechanism of articulate sound in motion so as to produce the objective signs of which he has a definite conception. These latter cases are not to be described as instances of aphasia but of aphemia, and it is probable that conditions similar to aphemia are what we have to deal with as part of those general defects of cerebral development that we find associated with congenital cleft palate.

As it would scarcely come within the scope of the present work to enlarge on this subject, it will therefore be well to epitomise the facts and observations brought forward, and leave the matter for further thought and investigation. We have then to bear in mind these points.

1. There seems a definite relation between palate and cranium; certainly as to length and breadth, probably as to outlines.

2. In palatal deformity or interference with the mechanism of speech, there seems to be in a large number of cases asymmetry of the brain-case.

3. In strongly marked cases of malformation of the upper or lower jaws, there is equally well marked asymmetry of the skull.

4. In a notable number of cases this flattening of the cranium, is on the left side.

5. It is generally admitted that the language,

speech, and sound centres are chiefly on the left side of the brain.

6. Evidence is obtainable that structural defects, mechanical injuries, or pathological changes involving these parts produce defects of language and speech.

7. In so far as functional activity and capacity may be taken as measures of organic perfection or otherwise, it may be assumed that certain cases of cleft palate, or the subjects of some other deformities in the maxillary region, who have also a deficiency in the articulate sound function, are also deficient in the articulate sound nerve centre.

8. And as it has already been shown that congenital structural defect of the brain is frequently associated with physical deformity of the skull, so it may be useful to regard the conformation of the skull as part of the evidence by which we may estimate the development of the brain, especially in regard to those points to which attention has been drawn in this chapter.

9. If it be possible to avail ourselves of the facts that are stated, and the inferences that are indicated, we may be able to prognose with a greater degree of certainty the future language and speech capacity, of sufferers from palatal and maxillary deformity of a congenital origin.

CHAPTER VII.

ON THE TROUBLES ARISING FROM CONGENITAL CLEFT OF THE PALATE. DIFFICULTY OF SUCKLING DURING INFANCY. RETARDED DEVELOPMENT OF THE BODY FROM INSUFFICIENCY OF NUTRIMENT. DEFECTIVE SPEECH. INFLAMED STATE OF NARES, FAUCES, ETC.

When a child is born with hare-lip, the attention of the medical practitioner or nurse is at once attracted, and an examination made of the mouth to ascertain whether it is complicated with cleft palate. If, however, there be no deformity of the lip, the simple cleft may not be observed until the child begins suckling. If the cleft be small and confined to bifurcation of the uvula, this will not cause much trouble, but should it extend through the soft palate into the hard, the milk will be found oozing through the nose instead of passing from the mouth into the pharynx in the normal manner.

Under these circumstances, the child will have to depend for its support upon the nourishment that can be administered to it by means of a spoon or feeding-bottle. The latter is undoubtedly

the better plan of the two, and the little patient may be very much helped in the process of receiving its food by having a contrivance, shown in the accompanying wood-cut, attached to the neck of the mouthpiece of a Maw's feeder.

FIG. 34.
The palate-piece alone.

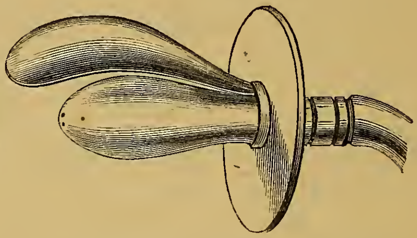

FIG. 35.
The palate-piece attached to the ordinary nipple sold with Maw's feeding bottle.

This consists simply of a flap of elastic India-rubber made to fit to the roof of the mouth. The pressure of the nipple against its under surface when in position converts it into an artificial palate-piece, and prevents the escape of the milk into the nose in the effort of swallowing. It was suggested some years back in an article by Mr. G. Williams, in the *Dental Review*, that a flap of thin sheet elastic, not modelled to the arch of the palate, but simply cut out and sewn on to the feeder should be used; when it is not convenient to obtain such an one as I have just described this is a very good expedient, but if it is possible to procure a properly-fashioned arrangement, it is

evident the discomfort and anxiety that must arise in these cases will be very much lessened.

Sponge or leather* is sometimes used for the same purpose, but is on many accounts very objectionable, becoming sour and offensive after use, while the vulcanised rubber can be kept perfectly sweet and wholesome by means of washing in warm water.

My friend, Mr. Mason, has suggested the use of a metallic plate attached to the nipple of the feeder, the plate being made of a shape corresponding to the vault of the palate. This plan though it has answered in several cases in which Mr. Mason has used it, seems to be open to the objection of presenting an unyielding surface and margins to the delicate mucous membrane of the mouth of the infant. If metal is to be used at all, a better plan I think consists in making a dome shaped cover and soldering it to an ordinary egg or tea-spoon, leaving it open at each end so that the milk can readily flow in and out and yet be conveyed to the back of the mouth without risk. A covered spoon is really a most efficient contrivance in the hands of an intelligent nurse.

I have sometimes found, however, the child so exceedingly delicate, that but little chance existed of saving the infant's life unless it could be sup-

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* Snell, on "Artificial Palates." 1828.

plied with nourishment from the mother's breast; I have therefore prepared an artificial palate, attached to a shield to go over the breast and thus enable the little one to take its natural nourishment. Being made of thin elastic rubber it is not uncomfortable, and can be kept perfectly clean, while from the form it is made in, it can be used for either breast. It is shown in position in the accompanying woodcut, Fig. 36.

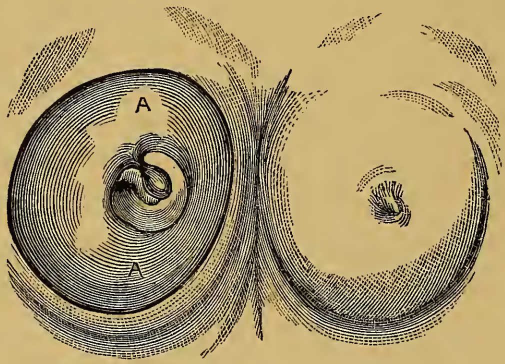


FIG. 36.
The breast shield, and palate.

Under the most favourable circumstances, and when the greatest possible care is exercised, there is little doubt that the growth and development of the child is very much retarded, though its constitution may not ultimately suffer in consequence of the defective palate, beyond that delicacy of frame which is very often the accompaniment of extreme parental anxiety and watchfulness.

Hare-lip.—The time for operating upon the hare-lip will have to depend upon the state of health of the babe, and may take place a few hours or several months after birth, according to circumstances. This is a matter exclusively in the hands of the surgeon, and quite beyond the province of the present work to enter into, except in reference to one or two points which I desire to submit to the consideration of those who are in the habit of frequently performing the operation.

When the division in the lip is bilateral, and the inter-maxillary portion of the jaw is apparently very prominent, it is usual in a large number of cases to remove the bony protuberance altogether, using the middle portion of the lip for the columna nasi, and then, having pared the edges of the side flaps, to bring them together in the median line.

The result of this treatment in after-life is to give to the upper lip an exceedingly flat unsightly appearance, and to the lower lip a relaxed and pouting expression as shown in Fig. 37.

If the patient's face be looked at from the side, the contour of the countenance would seem to indicate that only a part and not the whole of the intermaxillary process should have been removed, since its prominence was apparent rather, than real, and was undoubtedly due principally to the great want of substance on each side,

and not to an excessive development in the median portion. In Fergusson's work "On the Progress of Anatomy and Surgery during the last Century," this is suggested as a reason, and drawings given of a case by which it is proved how little deformity need occur when the patient is in the hands of a skilful operator. In the same chapter it is also pointed out that the notch in the lip, so often observed in after-life, is mainly owing to the

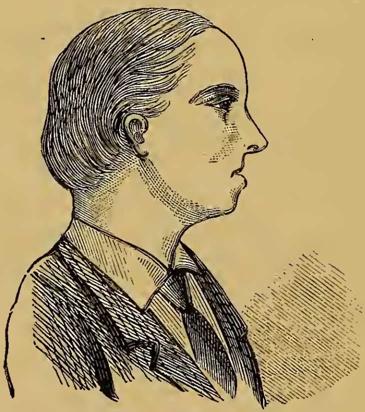


Fig. 37.

edges of the divided lip not being cut away to a sufficient extent, so as to bring the skin and mucous membrane into proper contact with each other. Nor is this question merely one of æsthetics, the triangular gap left in the lip by the irregular union of the two lateral portions, seri-

ously impedes perfect articulation, by rendering it impossible for the patient to close the lips completely. The explosive sounds, such as *b* and *p*, thus become indistinct, and in some instances quite unintelligible.

The pouting of the lower lip to which I have referred, is in every instance a positive deformity in itself, causing the saliva to dribble from the corners of the mouth, and preventing anything approaching to perfect labial articulation. That it is due to the unequal contraction that has taken place in the upper lip subsequently to the operation for closing the gap, there can be no doubt, and the simplest remedy for the deformity, seems to me to consist in taking a V shaped piece out of the centre of the lower lip. The operation would be a very simple one, and would leave only a line of union that ought not to attract attention, whilst it would certainly improve the mouth very much, and make the lips much more serviceable in speaking.

During infancy but little difference is observable in the tone of the babe's cry, but when the time arrives at which the child should, under ordinary circumstances, begin to give utterance to "articulate" sounds, it becomes apparent how greatly the deformity interferes with speech.

In many cases no amount of attention, apart from a mother's instinct, will enable the listener to

understand what the child attempts to say, and this imperfect articulation is not regulated, as might be expected, by the extent of the cleft, but is almost as bad in simple division of the soft palate as in those cases where there is also division of the hard palate and alveolus.

This is capable of explanation however, in part at least, if the views I have put forward in reference to cerebral development in these cases be taken into consideration.

From birth up to seven or eight years of age the cleft increases both in width and length, in proportion to the rest of the mouth, unless, hare-lip being associated with it, mechanical means are used to compress the parts laterally, by the use of a truss, such as we find described in the work by the late Sir William Fergusson already referred to. The gap, by the use of a truss, may be reduced to such an extent that at the anterior part the two sides of the divided alveolus will become closely approximated and appear continuous. After the age I have mentioned I am led to the conclusion, so far as my own opportunities of observation have gone, that the cleft simply increases in length, the width being in the majority of cases the same at twenty-one as at eight or ten years of age.

From eight to ten years of age the patient will become first conscious and sensitive of his or her

defective speech. At this age, too, nourishing food properly masticated is of great importance. Both these circumstances, therefore, would seem to point to it as the best time for the insertion of an artificial palate, unless the operation of staphyloraphy has been performed during infancy; for it will be well-nigh impossible in a case of cleft in the hard and soft palate to apply the food with the tongue to the roof of the mouth in such a way as to ascertain when it is ready for swallowing. The consequence will therefore be that a considerable quantity of that which should yield the most nutriment is received into the stomach in such a state as to impair the digestive organs. There is also the liability during childhood of the cleft getting filled up with solid food, and in some cases causing suffocation.

The difficulty of controlling the passage of air through the nares by means of the velum palati in nearly all patients gives rise to a most pernicious habit of checking it by means of a contraction of the alæ of the nose through the action of the compressor nasi muscles, thus to a certain degree rendering the utterance more distinct, but giving a very disagreeable "nasal twang." It is wonderful to what an extent these muscles come under the patient's control. In the French language this would not be of so much consequence. In the Anglo-Saxon tongue, however, it is a con-

siderable annoyance, and it is most difficult, when the habit is firmly established, for the patient to overcome it. Still, if an artificial palate be inserted at the time I have indicated, it may be prevented or checked to a very great extent, and finally be entirely forgotten or superseded by the patient finding it unnecessary to control the passage of air through the nostrils, except by the means provided in the elastic velum.

From the great exposure of the nares and fauces to the air, in large perforations or cleft of the palate, these parts are exceedingly liable to inflammation and ulceration, extending into the pharynx and larynx, and during the winter months causing frequent sore throat and deafness, as well as loss of voice. Considerable irritation arises also in the cavity of the nose from the mucus drying on the turbinated bones and margins of the fissured palate, in consequence of the too free access of air to these parts. All of these symptoms, however, disappear when the cause is removed, either by operation or mechanical treatment, though the latter, perhaps by checking to a greater extent the passage through the nares, and also acting as a stimulant to the normal secretions may prove the more efficient of the two for this purpose.

CHAPTER VIII.

SOME ACCOUNT OF THE APPLIANCES USED FOR REMEDYING CLEFT PALATE (WHETHER CONGENITAL OR ACCIDENTAL) FROM A.D. 1552 TO THE PRESENT TIME.

An account of the progressive stages by which we have arrived at the present comparative perfection of artificial palates may not be uninteresting to my readers, or out of place in a work of the present kind.

My principal authority on this subject is Snell, who took great pains to collect all that it was possible to glean, as to the contrivances used by our forefathers for remedying this deformity.

Little is known or said on the matter till the fifteenth century, though Isaac Guillemeau, in his work published in 1649, mentions the name by which the Greeks called the appliances for filling up the cleft; thus leading us to infer that they were acquainted with some method of treatment for perforation or cleft of the palate.

In order that we may more easily see the time that was occupied in passing, stage by stage, from one improvement to another, I propose to

arrange the names of those surgeons, dentists, and others who have paid any attention to this matter in chronological order.

1552.—Hollerius, in his "Observ. ad Calcem de Morbis Internis," proposes to stop the apertures with wax or sponge.

1565.—Alexander Petronius, in his "De Margo Gallico," proposes, when there is but one opening in the palate, to stop it with wax, cotton, or a gold plate, taking care to give to the instruments the same concave form as the roof of the mouth. Though this is the first mention of a gold plate being used for this purpose, still, from the fact of Petronius not being more explicit as to its mode of fitting and retention in the mouth, we are, as Snell very justly observes, led to the conclusion that the remedy was one with which his readers were not altogether unacquainted; and we must not therefore give Petronius the credit of being the inventor of this mode of treatment.

1579.—Ambrose Paré, in his book on surgery, published in Paris, and in the year 1649 translated into English by Thomas Johnson, proposes that the cavity should be covered over by a gold or silver plate, "made like unto a dish in figure, and on the upper side, which shall be towards the brain, a little sponge must be fastened, which when it is moistened with the moisture distilling from the brain will become swollen and puffed, so

that it will fill the concavity of the palate, that the artificial palate cannot fall down, but stand fast and firm as if it stood of itself."

1649.—Isaac Guillemeau, in his "De Ouvres," gave a drawing of an instrument similar in form to Ambrose Paré's instrument; but suggested that, as it was not always possible to adapt the plate perfectly to the roof of the mouth, a lining of sponge or lint should be applied, in order to render the closure more complete.

1653.—Amatus Lusitanus, in his "Curat. Medic. Centur." mentions a boy with diseased cranium and perforated palate, whose voice was restored by means of the gold plate and sponge.

1685.—Nic. Tulpius, in his "Observat. Medici," mentions the same mode of treatment.

1715.—Garangeot, in his "Treatise on Instruments," is the first that we find making any step in advance of his predecessors with regard to the construction of obturators. Describing one, he says:—"This instrument has a stem in the form of a screw, upon which runs a nut. To make use of it, take a piece of sponge, cut in the shape of a hemisphere, with a flat surface; pass the stem of the obturateur through the sponge, and fix it by means of the nut. Dip the sponge in water, squeeze it dry, and introduce it through the aperture."

1723.—Fabricii Hieronimi, in his "Chirurgicis Operationibus," recommends sponge, lint, or silver plate; not suggesting any new form of instrument. He is the first, so far, that is, as I have been able to examine these old works, who make specific mention of congenital cleft palate in contradistinction to accidental cleft or perforation.

1734.—R. Wiseman, Sergeant-Surgeon to King Charles II., in his Chirurgical Treatises gives evidence of having bestowed much thought upon the treatment of the defects of the palate, though he cannot be said to have made much real and practical progress. His novelty in treatment consisted in filling up the cleft with a paste composed of myrrh, sandarac, and a number of other ingredients. His idea was certainly in advance of his time; for by this means a most important end was gained—that of perfect exclusion of air by its complete adaptation to the margins of the cleft. We are unfortunately not informed how this "paste palate" was kept in position.

1739.—Heister, in his "Institutions of Surgery," suggests the use of "a gold or silver plate adapted to the perforation, and furnished with a handle or small tube, which, being armed at the top with a sponge, he may thereby exactly close the perforation.

1754.—Astruc, in his "Treatise on Syphilis," makes the first mention that we have of a silver button to the metallic obturator, in place of the sponge, in order to avoid the unpleasantness arising from the absorption of mucus.

1786.—M. Pierre Fouchard, in his "Chirurgeon Dentiste," gives an account of some instruments which show a very great improvement on the forms previously in use; the sponge, as a means of support to the obturator, being substituted by an arrangement of metallic wings, worked into proper position after introduction into the cleft, by means of a hollow stem and nut, which, when screwed down, kept the wings (covered with soft sponge) across the aperture.

There are descriptions given of others on the same principle, and of one on a then new plan, depending for its support upon ligatures round the canine teeth.

It will thus be seen that more than two hundred years elapsed before any decided improvement took place in this department of dental science. MM. Dubois Foucou, Touchard, Bourdet, Cullerier, and De Chamont give descriptions of a variety of obturators, all more or less resembling the instrument of Fouchard, with its arrangement of wings, clasps, and screw-nuts.

1820.—The next advance made was by M. De la Barre, who is the first to mention the use of "elastic gum" in the restoration of the velum and uvula. The artificial palates designed by this gentleman were ingenious in the extreme, but of such a complicated nature that none but a man of considerable mechanical genius could ever hope to be successful in their application. Still we must bear in mind the great step taken towards the present instruments in use by the introduction of "elastic gum."

1828.—I now come to a consideration of the artificial palates constructed by Mr. Snell, who arrived at much more satisfactory results in his method of treatment than his predecessors could have done, from the fact that he first obtained an accurate model of the mouth, on which he mounted and fitted his obturator—a point that up to this time is not mentioned, even if it were practised.

He says in his book that, with the exception of one method proposed by Mr. Alcock, in the *Medical Intelligencer*, he is not aware of any successful mode of treatment for remedying congenital cleft of the palate excepting his own plan, which he goes on in the next pages to describe in the following words:—"My method of constructing an obturator is, with a gold plate, accurately fitted to the roof of the mouth, extending backward to the os palati, or extremity

of the hard palate, a part of the plate, about an inch in length, being carried through the fissure. To that part of the plate which answers to the nasal fossæ are soldered two plates, meeting in the centre and carried upwards through the fissure to the top of the remaining portion of the vomer, to which it should be exactly adapted, and made to the natural shape of the nasal palatine floor: thus the fluid of the nose will be carried directly backward into the fauces. A piece of prepared elastic gum is next attached to the posterior part of the plate, where the natural soft palate commences, extending downward on each side as low as the remaining part of the uvula, and grooved at its lateral edges to receive the fissured portions of the velum. A movable velum is placed in the posterior centre of the elastic gum. That these may partake of the natural movements of the parts during deglutition, a spring is affixed behind them, one end of which is fastened to the posterior and anterior surfaces of the principal plate, and the other end rests gently against the posterior face of the india-rubber; this keeps it always in close apposition with the edges of the fissure during deglutition.

"It is requisite here to mention that the elastic gum should be placed in a gold frame, and not merely fastened to the posterior part of the plate,

as it would shrink up by remaining in the mouth. This frame should pass round its edges only, leaving the centre open. The anterior lateral edges should be made to come considerably over the sides of the fissure, which will prevent their slipping behind it during their altered positions; the whole apparatus being held up by elastic gold springs round the teeth on each side."

1845.—Mr. Stearn, a surgeon of London, in this year communicated four articles to the *Lancet* on congenital deficiency of the palate, when he gave a description of an instrument which he had contrived for the treatment of these cases; it was in some respects like the obturators of De la Barre and Snell, though more difficult to construct than either of them.

From a description of one constructed by the Drs. Tucker of Boston, drawings of which I have reproduced from the eighth edition of "Haris's Dental Surgery," I am enabled to bring before my readers an accurate idea of the nature of this very interesting instrument.

It consisted of a gold plate, fitted across the hard palate, having attached to it, by means of two spiral springs, an artificial velum of elastic rubber, consisting of a body, wings, and grooved edges to receive the margins of the cleft.

"Fig. 38 shows the lower surface of the palate-plate and anterior surface of the velum; *a*, the

palatine plate; *b*, the flat spiral springs, extending from the posterior margin of the plate to the upper part of the velum; *c c*, wings of the velum, *d d*, the flange; *e*, the central portion.

"Fig. 39 shows the upper surface of the palate-plate, and the posterior surface of the velum and spiral springs; *a*, the palate-plate; *b*, the spiral springs; *c c*, wings of the velum closed; *d d*, the

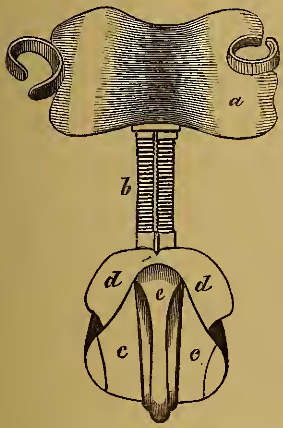


Fig. 38.

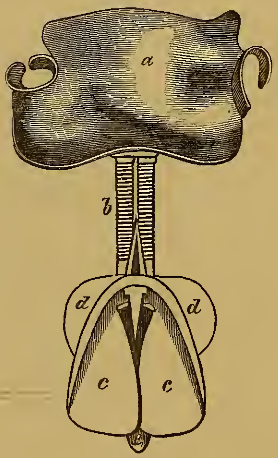


Fig. 39.

flange, as seen above the wings; and *e*, the central portion below the wings, and intended to represent the uvula.

"Fig. 40 represents the velum with its wings separate from the plate, showing the central portion, before being attached to the hook, at the lower extremity of the flattened spiral springs.

"In fig. 41 is represented a side view of the velum, showing the groove between the flange and the wings, for the reception of the fleshy sides of the fissure."

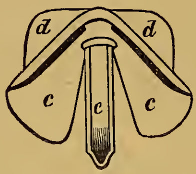


Fig. 40.

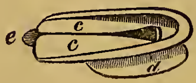


Fig. 41.

1857.—Mr. Sercombe, who had for some time paid a great deal of attention to the treatment of cleft palate, in this year gave a description of the instrument he used in remedying this defect, in a paper which he read before the Odontological Society, entitled "Cleft Palate, its Surgical and Mechanical Treatment."

From that paper we extract the following account of the instrument, with a drawing of one that had been successfully applied to a case, and worn for two years.

Mr. Sercombe says,—"My velum is made of two pieces of vulcanized India rubber, the larger piece extremely thin, the smaller piece much thicker; the shape of both is represented in fig. 42. The dotted line shows where they are

attached by sewing to the posterior margin of the gold plate, which has a single line of holes punched in it for this purpose. The exact size of the larger piece will vary in each case. . . . This piece should also be extremely thin, to adapt itself to the ever varying sides of the fissure; but a piece of such tenuity as to secure this vital point, weighted with mucus, would quickly droop, but for the support which is given to it by the smaller and stouter piece which lies immediately underneath it.

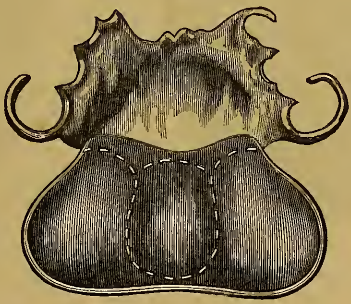


Fig. 42.

"These two pieces of sheet rubber sewn to the posterior margin of the gold plate—the thinner to its upper surface, and the thicker to its lower—have been found, in more than one instance, to restore to the person using them a distinct articulation."

Since Mr. Sercombe's death I have had the

opportunity of seeing many of the cases that he had treated, and he most certainly obtained results that I have never seen surpassed by any other means.

In 1862 Mr. Williams exhibited the following case, showing his mode of treatment:—

FIG. 43.

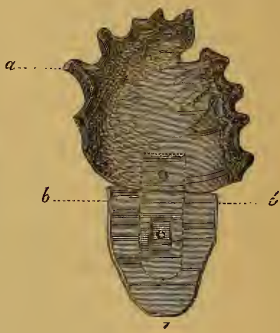


FIG. 44.

This was a case of complete fissure of the hard and soft palate, the fissure extending through the whole of the hard palate and uvula.

Fig. 44 represents Mr. Williams' obturator for the above case. The portion A, which covers the hard palate, is constructed of hard vulcanite. The velum, or soft palate, *b*, *b*, *b*, is formed of soft vulcanite; the two portions being united by a narrow band of elastic gold, which allows the

artificial velum to follow the muscular action of the palate.

1864.—In this year Dr. Norman Kingsley, of New York, brought before the Odontological Society of Great Britain, a method of treatment that demands the highest praise on account of the perfection of the method by which his results were obtained. The instrument itself was not altogether new in form, being to some extent very similar to that which had been constructed some years before by Mr. Stearn.

The interest attaching to the paper was rather the account of the *modus operandi*, which was briefly mentioned, the two great novelties in Dr. Kingsley's treatment consisting in taking an impression of the parts in plaster of Paris instead of wax, and preparing the elastic rubber velum in metallic moulds, rendering replication of them a very easy matter.

The instrument, and a description of its various parts, are shown below.

Fig. 45 represents the lower, and fig. 46 the upper part of an artificial velum. A, indicates the groove in which the sides of the cleft repose; F, the posterior end, which may come in contact with the wall of the pharynx. The surface, B, lies next the tongue. G, springs of the same material, which assist it to keep its form and place. The points E rest on the top of the bone

at the apex of the fissure. D, the hole through which the attachment is made, to keep it from running back.

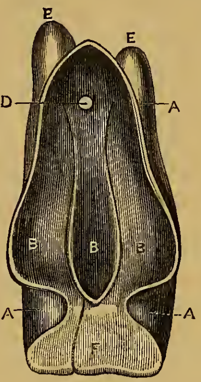


FIG. 45.

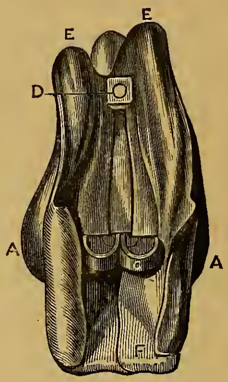


FIG. 46.

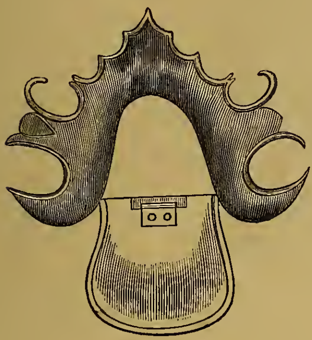
1865.—Mr. Robert Ramsay, in a paper on the "Treatment of Congenital Cleft Palate," brought an instrument before the above-mentioned Society, made on Dr. Kingsley's principle, but much simplified in construction.

1867.—Mr. George Parkinson, in a communication to the *Lancet*, made the following remarks on his method of treating cleft of the hard and soft palate.

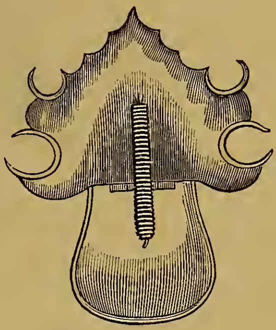
(I have reproduced the drawings by which his article was illustrated, in order to render it the more interesting.)

"In a case of congenital fissure of the palate extending through the hard tissues and alveolar ridge, after having taken a correct model of the

parts in wax or plaster of Paris, I commence by fitting a thin plate of gold over the vault of the palate, as far back as the posterior margin of the palate bone would have extended had the bony



Palatine surface.
Fig. 47.



Nasal surface.
Fig. 48.

arch been perfect. To the posterior margin of this plate, by means of a hinge, is attached a velum, constructed of hard, well-polished vulcanized India rubber, formed in such a manner as to fit the palatine surface of the remnants of the soft palate, and allow them to glide over it in the act of deglutition. To keep the velum in its place, one end of a delicate gold spiral spring is made fast to it, the other end being fixed on the nasal surface of the gold plate representing the hard palate. This spring must be so adjusted as just to keep the india-rubber velum in contact with the soft parts, and allow the portions of

uvula on either side to approximate in the act of deglutition."

FIG. 49.

Fig. 49 represents an obturator made entirely of hard rubber by Hofrath Dr. Wilh. Suersen, Sen., of Berlin. A gold medal was presented to this gentleman, on account of his invention, by the Central Association of German Dentists, and from my own experience it offers remarkable advantages in some cases of congenital cleft.

It is impossible to mention all those who have treated by one means or another the defects of the organs of speech and deglutition, I can only name some of them; and trust, at a future time, to have an account of the special modes of treatment adopted by Dr. Bogue, of New York; Dr. Rottenstein and M. Préterre, of Paris; Mr. Charles James Fox, and Mr. Vasey, with others of London.

I have endeavoured to trace, briefly, it is true, from the first accounts given, the successive stages by which we have arrived at the present mode of treatment showing the development of the principle that the obturator should not simply fill up the gap in a cleft palate, but be so constructed as to work on physiological principles with the natural movements of the sides of the cleft.

In 1844 Sir William Fergusson demonstrated the precise action of the muscles of the cleft palate; and in 1845 Stearn gave to the profession an account of an instrument which, from the movements it was capable of, I am led to conclude was constructed with a view to utilizing the peculiar muscular action which the year before had been shown to exist by Fergusson.

This may have been simply accidental, but it is worthy of note.

In Dr. Kingsley's appliance the matter was more fully developed, but this instrument, in the form in which it was first introduced into England, had, like Stearn's, the fault of being too complicated for general use. In reference to the method of treatment I have myself adopted, it is impossible for me to give one form of instrument in particular, and say that it is the special form that I prefer. I endeavour in every instance to adopt an obturator that will best meet the necessities of

the case, not confining myself to one set rule, always bearing in mind, however, the important point of supplying the congenital cleft with an instrument that shall, if possible, depend for its support upon the overlaps to the margins of the cleft, and not upon the teeth.

Some years ago I attempted with most satisfactory results, the imitation in the elastic velum of all the parts that nature had left undeveloped, and the following woodcut (fig. 50)

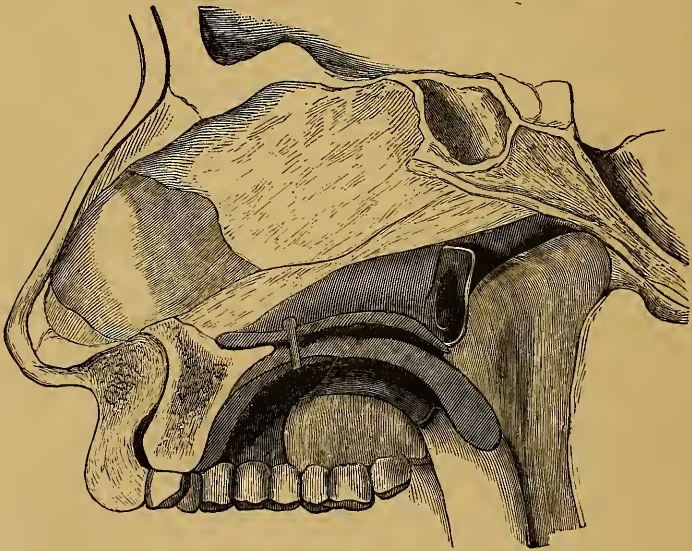


FIG. 50

shows in section the case (described more fully further on), in which will be seen the nasal septum, posterior opening to the nares, with the velum and uvula reproduced.

In the subsequent chapter, containing an account of the treatment of cases, are given the further variety of forms that may be used under different circumstances.

CHAPTER IX.

ON TAKING THE IMPRESSION FOR AN ARTIFICIAL PALATE. MAKING THE PLASTER AND METALLIC MOULDS. VULCANIZING. VULCANITE. FRONT PIECE, ETC.

It will be readily understood from the descriptions that have been given of the various appliances that may be adopted for the treatment of congenital fissure of the palate, that successful results in a great measure depend on the accuracy of the impression from which the model is made.

The materials generally used for taking impressions of the mouth are wax or some other plastic preparation, such as gutta-percha, Stent's, or the Godiva composition ; but experience has shown that these substances are by no means satisfactory, especially in taking impressions of parts that are so easily displaced as the soft palate. For none of them can be used, under the most favourable circumstances, without applying pressure sufficient to render the impression and subsequent model incorrect.

It being necessary to introduce some prepara-

tion into the mouth in such a state that it will not move the most delicate fold of mucous membrane, while in a short time it shall become so hard as to admit of removal without any alteration of form, it is clear that plaster of Paris is the best material, and so satisfied am I with the results obtained, that for even small cases of artificial teeth in the upper jaw I would recommend it as preferable to wax, or Godiva, or Stent's. For the lower jaw, however, although on many occasions I have carefully tested it, I cannot recommend its use.

In most cases the soft palate will be found too sensitive at first to admit of a full impression being taken at once, or even of the holding of the impression plate in position sufficiently long to admit of a model being taken. Two courses are open to the operator to overcome this difficulty: one is, to begin by taking an impression of only the front of the mouth and cleft, and then on successive occasions gradually extend it backwards, till at last you are enabled to get a good impression of the whole of the parts, extending outwards to the alveolar ridge upwards to the remains of the vomer, and backwards to the posterior wall of the pharynx and laterally to the pillars of the fauces. Another method is to paint the parts with a solution of bromide of ammonium or

tannin and glycerine, ʒi. to ℥iv. applied with a camel's-hair brush—fig. 51*—the irritation of the brush, and its gradual toleration by the patient, acting almost as beneficially as the preparation used.

One or other of these two plans must be adopted before any hope can be entertained of getting a good impression.

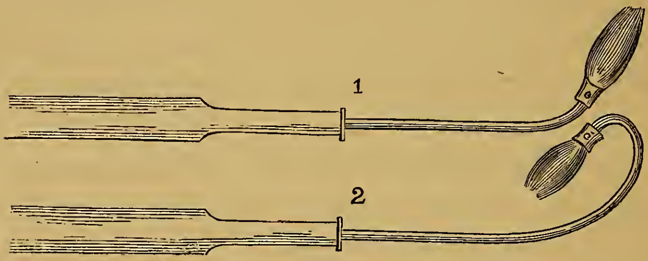


Fig. 51.

When the parts are rendered sufficiently insensible to the presence of a foreign body, an impression-tray must be carefully prepared, so as to fit in front closely to the teeth, and leaving at the back part a space about the eighth of an inch in extent from its surface to the corresponding surface of the soft palate. This does away with the necessity of an excess of plaster, and the consequent risk of any portion falling into the throat or upon the base of the tongue, and thus

---

* Made by Mayer and Metzler, of Great Portland Street.

producing such irritation that the utmost self-control on the part of the patient will scarcely be able to overcome.

The simplest, and on the whole, the best form of tray is that in the shape of a common spoon, made for me by the Messrs. Ash and Sons. This being of pewter, can be bent about to the desired outline, and covered with warm sheet gutta percha, which is placed on the tray, and put into the mouth. In this manner you get the outline of the teeth, which will act as a guide in introducing the tray with the plaster on it.

It occasionally happens in other than congenital cases, that the opening of the mouth is very much contracted, either from the effect of old cicatrices or gun shot wounds. This contraction may render it impossible to get a complete impression of the palate out of the mouth at one time.

To overcome this difficulty I have had trays

Fig. 52.

made of the form shown in Fig. 52 still in the shape of a spoon, but in two pieces, the handle of

each half overlapping the other; so that when the handles are brought into perfect contact the operator may be assured that the two halves inside the mouth are in their proper relative position to each other also.

The use of this variety of impression plate requires a little patience and skill to manage nicely, but there is no more difficulty than any one with ordinary tact will be able to overcome.

It may be used either with or without gutta percha on its surface. If gutta percha be used, care must be taken to roughen it, in order to give attachment to the plaster of Paris. If this be neglected, the liability is incurred of leaving the plaster in the mouth, and bringing the tray away alone.

The one half of the tray is first covered with a sufficient quantity of plaster, according to the case under treatment, and placed carefully on one side of the mouth, in such a position as to get a fair half of the impression, the right half of the spoon, of course, being used for the right side of the mouth. When the plaster is quite set, it is carefully removed from the mouth, and the straight edge which, with its fellow, is to form the median line of contact, pared down quite smooth, and flush with the edge of the spoon. The second half of the tray is then placed in its proper position with its fellow, to see that

no overhanging portion of plaster is present before putting them into the mouth.

All the surface of the half impression first obtained must be soaped thoroughly with brown Windsor soap, by means of a camel's hair brush, moistened either with water or sweet oil. When this is ready, fresh plaster is mixed in the manner hereafter described, and the impression already obtained is then placed again in the mouth, in the exact position it first occupied, and held firmly in place by an assistant, or the patient, if he has sufficient intelligence and nerve to be trusted. The second half is now covered with a sufficient quantity of plaster, and introduced into the mouth, so as to obtain an impression of the parts left exposed, after the first impression is in position. The guide, as to the situation of the moist plaster in the mouth, is given to the operator by means of the perfect apposition of the two handles, which should have all their edges flush with each other.

At the time of placing the second impression in the mouth, the head should be thrown forwards, and to one side, that is, to the right, supposing the impression has been obtained of the right side first. This will have the effect of bringing plenty of plaster into the central portion of the palate, and so produce a more accurate impression than if the head is kept perfectly straight.

When the plaster in the basin indicates that the impression is sufficiently hard to bear removal, the first half—not the last—must be detached from its fellow in the mouth. A firm, quick pressure downwards will do this; a sufficient amount of space will then be found to remain inside the mouth to admit of the removal of the second and softer portion without its suffering injury from dragging against the teeth.

By the time the first half is fairly removed the second half will be sufficiently increased in strength to bear taking away without any chance of damage. We now have the two halves of the impression out of the mouth; and if the directions just given have been carefully carried out, there should be no difficulty in articulating them with each other. They will be best kept in contact by means of binding wire tied round the handles, and the two articulating surfaces of the plaster being coated with liquid silex.

The perfect impression may then be cast in the usual way, according to the nature of the case.

For an impression of an ordinary cleft palate, where there is plenty of room to pass the plaster and tray in and out of the mouth, the plate having been prepared for use, the next step to consider is the mixing of the plaster. Two or three points require attention in reference to this (1) the dryness of the plaster, (2) its strength, and

(3) the time it takes to set, which will depend partly on its freshness, and partly on the state of the atmosphere, as well as on the temperature of the water with which it is mixed.

The best plan is to have the water with only the chill off, and then add salt in the proportion of as much as will lay upon a sixpence to half a pint of water. If you wish the plaster to set quicker than under these circumstances it would do, add to it before mixing a small portion of rouge. This will make it set so quickly, and so strongly, that increased care and watchfulness will be required with regard to the proper time for removal from the mouth. Everything being ready, the plaster is mixed in the ordinary manner to the consistence of thick cream, care of course being taken to break up all lumps in it during mixing; a sufficient quantity is then placed in or upon the impression plate, and the whole steadily introduced into the mouth and held firmly in its place, the precaution being adopted at the moment of putting the plate in position to incline the patient's head forward, so as not only to get a good overlap above the anterior portion of the cleft, but also to lessen the liability of any plaster running backwards and causing retching.

Now is the time to test the patient's confidence in the operator. If there is any evidence of restlessness or nervousness, he must divert the atten-

tion by some remark, or by examining the plaster remaining in the bowl in order to ascertain the precise moment for removing the impression from the mouth,—by these or similar means making the time (which should only occupy about a minute and a half) appear less, and so help the patient to endure the necessary discomfort. To those inexperienced in these matters all this instruction may appear superfluous, but the neglect of it will assuredly upon many occasions lead to an "embarrassing situation."

When the remains of the unused plaster in the bowl will break asunder and leave a clean, sharp fracture, then it is time to remove the impression from the mouth. If at the first it cannot be disengaged easily, then at once and without any hesitation use sufficient force to detach it, bearing in mind that at such a time every second's delay increases the difficulty. Under ordinary circumstances it will break away in the line of the margin of the cleft. This need occasion no alarm: only desire the patient to sit perfectly still and keep the mouth wide open; the operator can then without any anxiety or hurry, gently push the part which remains above the margin of the palate carefully backwards to the widest part of the opening, and, firmly seizing it with a pair of long tweezers (as shown in fig. 53) withdraw it.

The fractured parts, when put carefully to-

gether, will be found quite as efficient for use as if no breakage had taken place, especially if, instead of using resin and wax cement, they are united with liquid silex,* by which means any increase of bulk is avoided.

Fig 53. The entire length of these Tweezers is eleven inches with the handle.†

The impression, being thus perfect, must be carefully washed over with a solution of soap (brown Windsor is the best for the purpose), and the model made in three portions, as shown in the accompanying engraving (fig. 54.) We now return to the more commonplace operations of the work-room, and further minute particulars would only become tedious and unnecessary.

The model being ready for use, the artificial velum must be set up in gutta percha, having the exact shape which it will possess in its finished form. Here precise instruction is useless, as the formation of the palate-piece must depend entirely on the characteristics of the case

* "Liquid Silex." By Oakley Coles. *British Journal of Dental Science*, June, 1868.

† Made by Messrs. Ash and Sons, Broad Street, Golden Square.

and the ingenuity of the operator, but the illustrations of the various forms of vela will indicate the way in which they must be modelled for all ordinary palatine lesions. The gutta percha should be of the best description, and the model after boiling in stearine or resin and wax, prepared with soapstone, to prevent any adhesion to

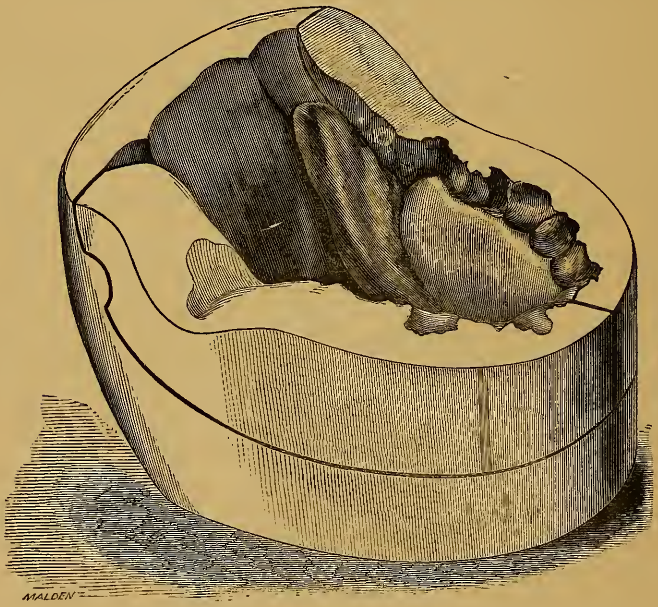


Fig. 54.

its surface. When this model velum is worked up to a satisfactory state, the casting of the plaster moulds can be proceeded with. For an ordinary case the best form is that shown in the engrav-

ing at another part of this work. They admit, however, of very many modifications, according to the shape of the velum that is being prepared. The plaster castings, when complete, must be duplicated in type metal, the best metal obtainable and the finest casting-sand being used. Great care must be taken here, as any imperfection in the metallic moulds will be communicated to the surface of the rubber during vulcanizing, and can only be remedied by clipping and paring, which will give a very unsightly appearance to the finished work. When the castings are complete, and the surfaces well polished with pumice powder and water by means of a stick of dog-wood, they should fit together accurately; if they do not, there is no alternative but to commence *de novo* till you arrive at a satisfactory result. Zinc or tin may be used, but are scarcely so satisfactory, being more liable to shrinkage than type metal.

The accompanying engraving (fig. 55) shows the castings separated, also the metallic pin fixed in the base for producing the hole in the velum by which it is attached to the hard rubber front piece. An error with this will be found to upset the entire arrangement. The greatest care must therefore be used in getting it into a good position, according to the shape of the cleft and mouth.

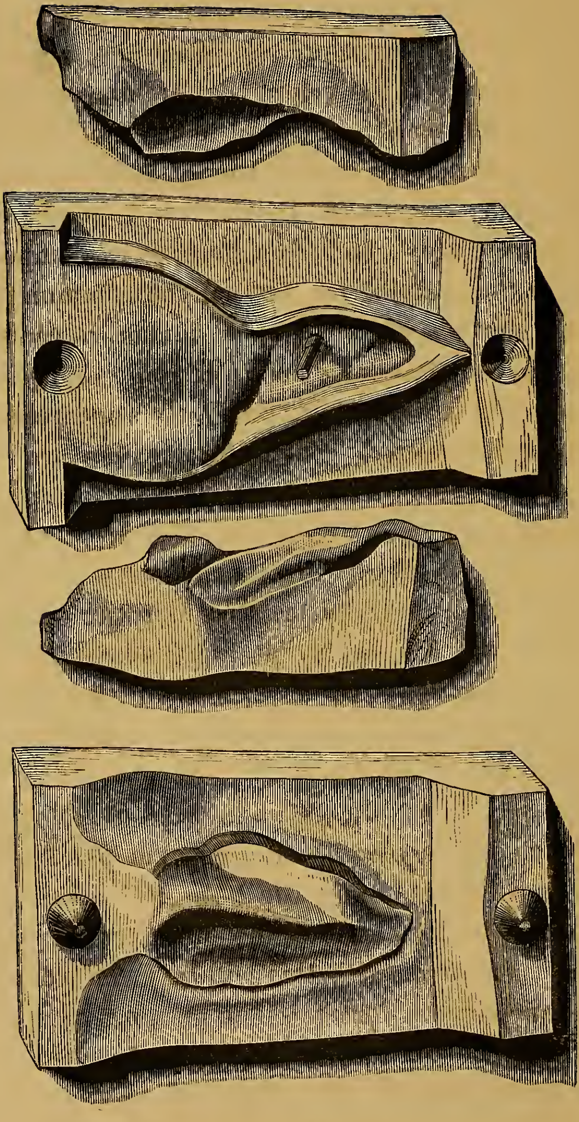


Fig. 55.

The moulds having been well soaped to prevent adhesion, and made warm—not hot—the next step is to pack them with elastic rubber. This is very easily accomplished: the two side-pieces, being adjusted to the base, or the middle and lower castings being united, should be kept firmly in position by an iron clamp, and the rubber packed in from above. When there appears sufficient, the top is put on, and the whole screwed tightly together, being put on a hot plate for a few minutes to soften the rubber, or placed in Gartrell's Vulcanizer and so warmed up. The casts are afterwards to be taken apart, any excess

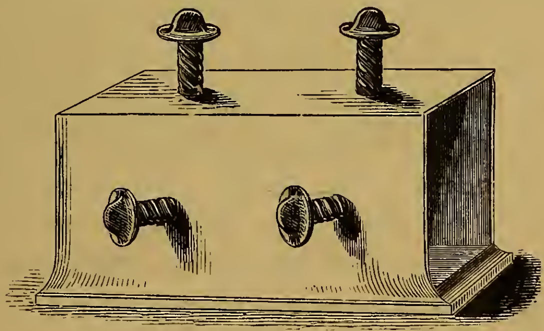


Fig. 56.

removed, or any deficiency filled up. They are again screwed up and fitted in an iron framework, as shown in fig. 56, with wedges to secure them, and put into the vulcanizer, or held together by clamps as shown in the illustration. In reference

to the rubber to be used, there can be no question that which is prepared by Messrs. Ash and Sons is by far the best, both as regards quality of materials and wear.

If this description of rubber be used, the time for vulcanizing is six hours; that is to say—

2 hours at 240°.
2 hours at 250°.
2 hours at 260°.

This will produce an artificial velum of the greatest elasticity and power of resistance to the acids of the mouth. It has occasionally been a subject of inquiry as to the description of vulcanizer that should be used for this rubber. Ten years ago, when the second edition of this book appeared, such a question was easily answered, as there was then only "the single screw" vulcanizer of Mr. Rutterford that could be strongly recommended; now, however, there are so many good vulcanizers in the market (though nearly all modelled on Mr. Rutterford's "single screw" system) that it is difficult to decide on any one as the best.

A boiler recently invented by Mr. Gartrell, of Penzance, has, however, much to commend it, from the fact that the flask, or casting, can be screwed up tighter, if necessary, after the lid of the boiler is closed. This is so obvious an advance on any other vulcanizer that it needs no word

of commendation. Rutterford's "single screw" vulcanizer will be found figured below.

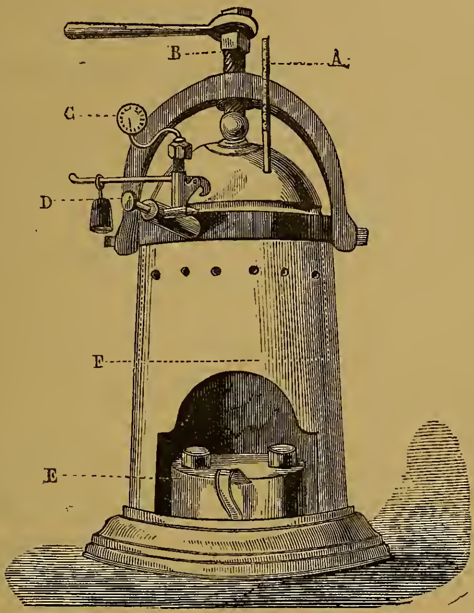


Fig. 57.

The adjustment of a front piece to keep the velum in the cleft will depend on the state of the teeth. If they are all perfect, a simple suction-plate, as shown in Chapter XI., is all that is necessary. If any teeth should be wanting, artificial ones to supply their place should be mounted on the front piece, as in an ordinary set of teeth; and if there be any deformity of the hard palate, as in most cases there is when associated with

hare-lip, it will have to be restored and made as symmetrical as possible by additions to the hard rubber. When, however, the anterior portion of the mouth is perfect, the palate should be made as thin as possible, and not extend further back than the second bicuspids, or first molar teeth.

The pin for connecting it with the elastic velum should be of soft platina wire, large at the top, so as to prevent it coming out of the hole in the artificial palate easily; that portion which goes into the hard rubber front piece being either notched and roughened by the file, or soldered to a small piece of plate at a right angle, so as to hold it firmly in the rubber.

The means by which a variety of other instruments and appliances are produced, will be found given with the cases to which they respectively refer in Chapters XI. and XII.

CHAPTER X.

ON THE INTRODUCTION OF THE INSTRUMENT INTO THE MOUTH. SUBSEQUENT TUITION. VALUE OF SINGING IN FACILITATING THE PROPER USE OF THE PARTS. IMPEDIMENTS TO PRODUCTION OF PERFECT VOICE.

The artificial palate and velum being completed, its introduction into the cleft is sometimes the source of a little difficulty in very nervous subjects, as the presence of the foreign body (though the mouth will by this time have become less sensitive) cannot at first be borne with patience.

It is well to try in the elastic velum alone to begin with, having it attached to a long piece of stout platina wire, one end being fitted into the pin-hole previously mentioned. This will allow of the velum being passed well down at the back of the mouth, in order to get the wings or flaps into their proper relative position without much strain on the soft parts, while, on account of the length of the wire, the operator is able to see what he is about. The velum can be drawn forwards into its proper place, and held there firmly for a

minute, or longer, if the patient can bear it. In most cases this produces no discomfort, while in others there is a feeling of suffocation, in consequence of the greater separation of the mouth from the nose during breathing. If excessive uneasiness be felt at any particular part, the velum must be carefully trimmed away till it becomes easy; and should the portion removed be of any great extent, new castings must be made for the metallic moulds, and another elastic rubber piece vulcanized, in order that there may be no permanent roughness to produce irritation of the mucous membrane. The fit of this portion of the instrument being satisfactory, the hard rubber front piece should be tried in, and adjusted with sufficient nicety for the patient to be able to remove and replace it at pleasure, metallic bands or wires being avoided as much as possible, the fact being borne in mind that the use of the front piece is not to support the velum, but to keep it in such a position that it will support itself, by means of the overlap above the margins of the front and sides of the cleft. When the fit of each part is considered satisfactory, they can be put together, and introduced in the complete form.

At this time it will be found advisable to order the patient one or other of the following gargles for the mouth :—

℞
Potass. Chloratis ʒij.
Sp. Vin. Rect. ʒij.
Glycerin. ℥j.
M Aquæ Rosæ ℥vii.

or

℞
Tinct. Krameriæ ʒj.
Glycerin. ℥j.
M Aquæ Destil. ℥vii.

The gargle should be used three times a day, as it will tend to allay the irritation of the mucous membrane, while at the same time it will check the excessive flow of saliva which is generally present in these cases.

The first discomfort of wearing an instrument in the mouth having been overcome, the question arises as to whether the patients should be put under a systematic course of instruction in regard to the proper use of the tongue and soft palate, or whether they should be allowed to follow their own will and pleasure in the matter.

After continued and increased experience in connection with this point, I find it impossible to lay down any fixed rule upon the subject; there are such varieties of temperament and various degrees of intelligence in the patients presented for treatment with this deformity, that to attempt to be specific in advice would only lead, if fol-

lowed, to perplexity and disappointment. I shall therefore only put forward such general directions as in practice have appeared to be beneficial.

With very nervous and timid patients I always recommend reading aloud,—in the first instance in private, and then before a friend who shall have sufficient discretion to give such an amount of instruction as shall guide the pupil, without causing any agitation in fruitless endeavours to pronounce some difficult letter or sentence.

By this means confidence is gained, and gradually the muscles of the throat and tongue will be got under control, so that not only the power to use these members properly will be acquired, but at the same time there will be the capability of preventing a return to those unnatural movements, which the absence of some portion of the palate may have caused.

For those of a hopeful and vigorous turn of mind, a teacher of elocution will be of great service, while others with a quick ear for sound, and impelled by a strong feeling of pride, will make as much, and in some cases more progress, when left to themselves.

There can be no question that, under any circumstances, it is of immense advantage if the patient can be induced to sing in a good loud voice with the accompaniment of some musical

instrument for a quarter of an hour regularly every day. The attention is thus diverted, and all the organs of voice and articulation brought into more vigorous action than in ordinary speech, while the fact of the vocal sounds predominating over the secondary or articulate sounds will encourage the patient to persevere, through the defect not being so apparent, while at the same time the tongue and soft palate will almost instinctively assume their normal muscular movements. That this is the case in stutterers and stammerers is a well-known fact, and experience leads me to believe that similar results (apart from the physical deformity) follow in cleft-palate cases.

There is one very perverse habit that the tongue acquires in some instances, namely that of applying itself constantly to the back of the lower incisor teeth, while at the same time its middle portion and base are elevated in an endeavour to close the cleft in the soft palate, and thus produce a more distinct utterance. In several cases the continual pressure at the back of the incisors has caused them to separate and protrude in a very unsightly manner. But this may be also partly dependent on arrested development of the lower jaw, which in itself induces increased pressure against the teeth by the tongue. This state of things has been generally accompanied by single

or double hare-lip, as well as the split palate. Mr. Skey, in his second edition on "Operative Surgery," page 544, recommends a pebble being kept in the mouth, or a glass bead tied at the posterior surface of the lower front teeth, as a remedy for the functional derangement.

This irregular movement of the tongue is not so common in patients having simply cleft of the soft palate as when it extends into the hard portion, and there produces deformity. After treatment by mechanical means, the presence of a foreign body in the roof of the mouth, seems to have a beneficial result in regulating this unnatural movement, and by causing the tongue to be placed more frequently at the back of the upper incisor teeth, facilitates the perfect articulation of the T, S, and other letters in which the sound is produced by the combined action of the two organs referred to. Where the operation for hare-lip has not been very carefully performed, there is often a triangular space left on the lips being approximated, near the point where union has taken place. This is sometimes a source of great trouble to the patient when he tries to produce the labial sounds, as it is next to impossible to get a complete closure so as to give a clear articulation of such letters as B and P, fig. 58. It will thus be seen that the necessities and conditions of each case must always be the guide as

to whether a professed elocutionist, a friend, or private and solitary effort is the best course to adopt in order to produce clear and intelligible speech, and that any arbitrary rules would only mislead the reader.

Fig. 58.

Although it may be confidently asserted that the attainment of such perfection in speech as shall allow the patient to pass through life without discomfort to himself, or attracting attention from others, is possible in the majority of cases, still there are instances in which the subject of the lesion may be either of such small

intellectual capacity, or possess such a highly nervous temperament, that no treatment in the world could be reasonably expected to be successful.

When the deformity of the mouth is the result of accident or disease, the reproduction of the lost part by artificial means will within a few days, and sometimes at once, restore the voice to its natural tone and clearness of expression; in congenital cases the time which must elapse before any result can be realized from the treatment varies from six days to sometimes many weeks, or even a year. The latter are, however, exceptional instances.

CHAPTER XI.

AN ACCOUNT OF THE TREATMENT OF CASES OF CLEFT PALATE AND OTHER CONGENITAL DEFORMITIES OF THE MOUTH.

The following cases of congenital cleft palate have been treated on one principle, though not in exactly the same manner.

The object has been in every instance to close, by means of an artificial palate, the defect in the mouth, and at the same time to offer every possible chance to a natural effort to reduce the size of the opening, and not under any circumstances to enlarge it.

I have arranged the cases according to their respective ages, beginning with the youngest, and not according to the dates when they were placed under my care for treatment.

Case I.—John T——; Aet 4.—Brought to me July, 1868, with fissure of the soft palate and partly of the hard palate. After some little trouble an impression was obtained, and an artificial palate fitted in as shown in the accompanying wood-cut, fig. 60.

The object and result of fitting in an artificial palate at this early age was to reduce the size of the cleft, and so ultimately render the voice less

indistinct than it would be if allowed to go on untreated.

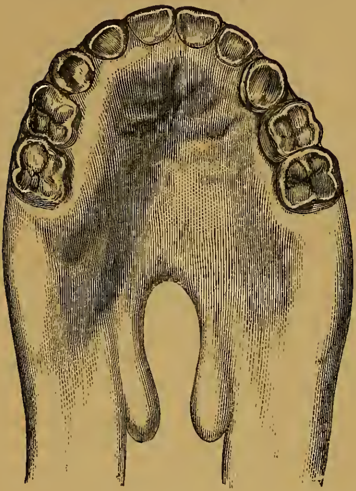


FIG 59.
Showing the fissure in the palate.

FIG. 60.
Showing the velum in position.

When the cleft is left unprotected, every act of swallowing, by the pressure exerted against the margins of the divided palate, tends to more widely separate them ; but if an elastic flap covers the opening, the pressure tends to flatten out the bundles of muscular fibres on each side and push them towards each other. The instrument in the present case has been in use for several years, and the results are most satisfactory. If it be urged that surgical treatment is ultimately a more satisfactory proceeding, this preparation only gives the surgeon a greater chance of success ;

and for this reason alone would be wise and justifiable to adopt.

Case II.—Mary S——; Aet. 7.—Brought to me July, 1868. Fissure of the soft palate only. This case was treated in exactly the same way as the last, the little patient taking the palate out and putting it in again with the greatest ease.

The child was of unusually small stature, and the cleft very diminutive; being confined to the soft palate entirely it required very careful treatment in so young a subject.

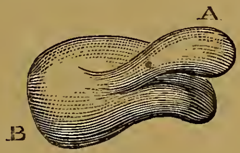


Fig. 61.

A. The over-lap resting upon the upper part of the cleft.
B. The flap forming the artificial velum.

It will be seen from the form of the instrument shown in fig. 61, that the overlap in no way prevented the reduction of the size of the cleft, while it supported the artificial velum independently of the teeth.

The overlap is connected with the flap of elastic rubber forming the artificial palate, by means of a narrow neck, so as to offer no impediment to contraction of the opening.

Case III.—E. A.——; Aet. 9.—was brought to me October, 1868, with cleft of soft and portion

of hard palate; the speech was very bad, and the child had a vacant unintelligent stare; with slight deafness in both ears.

The margins of the cleft were thick and widely separated; under no circumstances did they touch the posterior wall of the pharynx. I deemed this a most favourable opportunity for trying the utmost that could be done in the way of approximating the free borders of the cleft, and also spreading out the muscular fibres towards the posterior part of the pharynx. The front part of the arch of the palate was very deep, the teeth good and perfect.

On October 28th I fitted in a hard rubber palate, just reaching to the apex of the fissure. Strange to say, and greatly to my astonishment, the voice was immediately improved. This was worn for six or seven months; then I extended the posterior border of the plate over about one fourth of the cleft, but without putting any overlap. The child had got such power of suction in the front portion of the palate, that this was readily kept in place; every two or three months I increased this flap a little, until at the present time the cleft is completely closed by the artificial palate of elastic rubber. The front piece fits quite easily, and is the original plate made nearly two years ago, simply having the elastic rubber added to it from time to time. There is no over-

lap to any portion of the cleft, and the plate depends absolutely on suction for its support, not even fitting tightly to the necks of the teeth. When the velum is taken out it is most interesting to watch the movements of the sides of the cleft, the muscular fibres of which are flattened and spread out by the pressure from below of the elastic rubber. They can be approximated so as to come into actual contact, and the apices of the bifid uvula rest against the back of the pharynx as in a mouth without any deformity.

Fig. 62. Fig. 63. Fig. 64.

Fig. 62.—Shows the size of the cleft when at rest.

Fig. 63.—Shows the relative position of the parts when they are thrown forward.

Fig. 64.—Shows the "bulging out" and approximation of them towards each other. It is hardly necessary to add, that the speech has considerably improved during the last year and three-

quarters, so that the child can go to school and mingle with other children without any difficulty.*

Case IV.—W. S.——; Aet. 17.—Brought to me March, 1869, with cleft of both hard and soft palate, complicated with fissure of the alveolus on the left side.

The appearance of the mouth, when fitted with an artificial velum, and the central and lateral incisor teeth, that had not been developed, is shown in fig. 65.

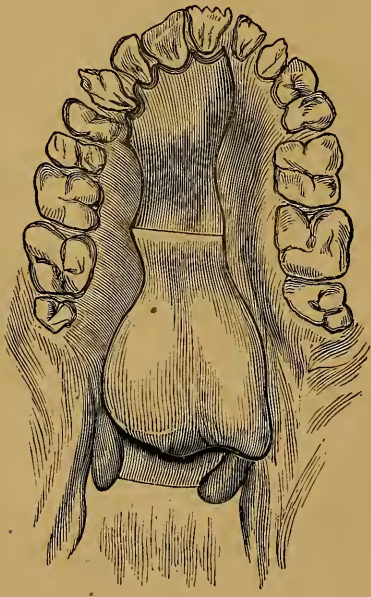


Fig. 65.

By a mistake in drawing this upon the wood, the cleft in the alveolus shows on the right side,

* I have not seen this case (a hospital patient) since 1871.

whereas, it was really on the left, as most of them are.

It will be seen that I have improved on the manner in which the hard and soft rubber portions are united together, by giving a continuous flush surface to them, instead of allowing the hard rubber to present a prominent ridge in the centre of the palate. Up to the present time this case has gone on exceedingly satisfactorily.

Case V.—Miss F——; Aet 17.—Seen by me

Fig. 66.
The model of the mouth.

June, 1868, fair complexion, nervous temperament. There was not much sensitiveness as regards the

deformity, and unfortunately no ear for musical sounds, though the young lady played several instruments with ordinary accuracy and ability. There was also slight deafness, probably arising from inflammation of the mucous membrane around the Eustachian tubes, the inflammation having arisen from the great exposure of the parts to every change of temperature in consequence of the opening in the palate. The mouth, when presented for treatment, had the appearance shown in Fig. 66.

A velum was made which restored the uvula

Fig. 67.
The artificial velum and front piece attached by means of the platina pin.

in the lower flap, and in the upper flap reproduced the septum of the nares where it was absent, also the two openings in the posterior nares.

By these means the mouth, nose, and upper

part of the pharynx were restored to their natural condition, and much satisfaction was afforded in a very short time, not only by the facility with which the patient could make herself un-

Fig. 68.
The mouth, as artificially restored.

derstood, but also by the improvements in the tone of the voice, which was unquestionably owing to the alteration that had been made in the form of the superior part of the pharynx.

Case VI.—D. W.——; Aet 38.—Consulted me

in June, 1869, in reference to a cleft in his mouth, extending through the hard and soft palate and alveolar ridge; there was an overlap on one side of the cleft only, the opposite margin articulating with the vomer.

Fig. 69.
The hard rubber, front piece.

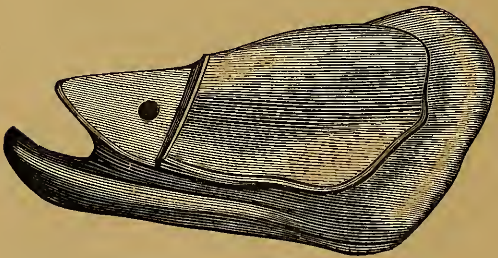


Fig. 70.
The elastic velum.

An instrument was made of the form shown in figs. 69 and 70. The drawings illustrate the manner in which the two parts are united, so as to present a smooth surface in the palate—a point of very great importance, when, under the most favourable circumstances, there is great difficulty in articulating with clearness. In this

case it will be seen, as in the previous ones, the artificial velum is held up by the overlap, and not by any attachments round the teeth.

The progress of the patient was quick and satisfactory, as regards improvement in speech.

Case VII.—W. H——; Aet 68.—Cleft of hard and soft palate, the hare-lip having been treated

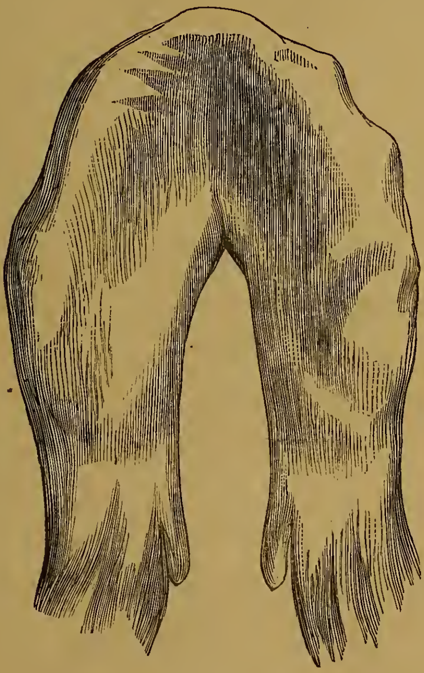


Fig. 71.

early in life. I was called in to see this case, in consequence of the patient suffering from a sensation of suffocation very frequently. Both the

upper and lower jaws were without teeth. The appearance of the upper jaw, with the cleft, is shown in Fig. 71. A lower set of artificial teeth was being worn at the time; and I was desired to close the cleft without producing any irritation in the nasal cavity. I therefore made an ordinary full upper set of teeth, and continued backwards from its posterior border an artificial velum of elastic rubber, simply covering the cleft without any overlap. The form was, however, so simple, that I think it unnecessary to give a drawing of it. The upper piece was connected with the lower plate by means of spiral springs, and fulfilled the special object it was made for in a most satisfactory manner, the patient having recovered and remained well ever since.

Case VIII.—Miss W.——; Aet. 19.—Brought to me March, 1869, suffering from thickness of speech, and inability to give the letters M, N, B, P, &c., with clearness. The young lady had suffered from enlarged tonsils, and had improved in utterance and general health since they had been removed, but her friends had still great difficulty in understanding her when reading, and when she suffered from cold, even during ordinary conversation, she found a difficulty in making herself understood. The roof of the mouth was very high, and the dental arch much contracted. It was not thought desirable that

anything should be done to remedy the contraction of the circle of the teeth, but an artificial palate was made to reduce the roof of the mouth to its normal depth.

Fig. 72 shows in section the peculiarity in the shape of the palate *(a, a)*, and at the same time shows the manner in which it was restored, by means of a hard rubber plate *b*.) Within three

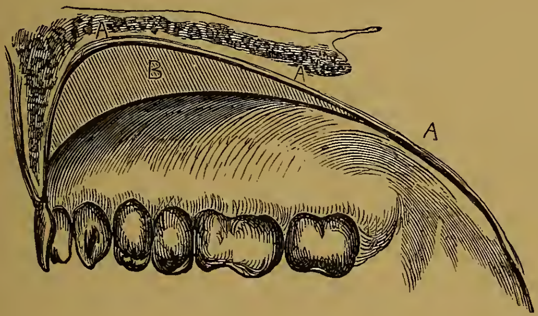


Fig. 72.

weeks the speech was much clearer, and the voice more agreeable in sound. At the present time, while the palate is worn, both voice and speech are almost perfect.

The construction of an instrument for this purpose is so simple that it is not necessary to say more, than that the impression having been taken in plaster of Paris, the palate was restored with wax to the proper shape, and the model put in the flask and packed with rubber in the usual

way. After vulcanizing, it was finished off very carefully, so as to give a thin edge to the borders, and not to offer any obstruction to the action of the tongue. The portion coming in contact with the palate was left unpolished, and, in fact, untouched, beyond washing off the plaster, in order that better suction might be obtained when fitted into the mouth.

These cases are very numerous, and with ordinary pains-taking, very successful and satisfactory in their results.

Case IX.—Miss M. R.——; Aet 12.—Brought to me June, 1869, with elongated palate and projecting incisor teeth. The history of the case showed most unmistakeably that the deformity arose from sucking the thumb during infancy and childhood; and the evidence of the mother—a lady of great intelligence—confirmed this view. She said, when she had severe pain herself, she was in the habit of sucking her thumb as a diversion from the suffering, and her three female children had got into a similar custom, without any occasion but that of imitation. The deformity was not hereditary, as both father and mother had well-formed dental arches, and rather flat than deep palates. I extracted the first bicuspid tooth on each side of the upper jaw, and made a vulcanite plate capping the side teeth, and having a broad band of elastic rubber, vulcanized with it,

and passing in front of the incisors and canines, these teeth having been first reduced in the front, on the model, in order that sufficient pressure might be brought to bear upon them in the mouth. In two months the teeth were brought into a fair position, considering the severity of the case. The projection of the lip was entirely reduced, but the teeth had an appearance—that is not uncommon in these cases—of being too long. The child will probably, however, grow out of this in a few years, as the whole of the face increases in size.

These cases may, however, in most instances be best treated by means of a broad metal band passing in front of the incisor teeth, soldered or rivetted to an overlap on both sides of the mouth, opposite the second bicuspid, which should be capped by the regulating plate.

CHAPTER XII.

DEFECTS OF THE PALATE ARISING FROM SYPHILIS.

Without entering into the medical treatment of syphilitic ulceration, it may not be an unsuitable introduction to give some of the leading features of this affection in the mouth.

Secondary syphilis seldom comes in the way of the dental surgeon, except when the teeth are affected either as a result of treatment or from the disease itself.

In the cases that come under the dental practioner's notice it is generally observed that either the tongue, fauces, or soft palate are affected. The ulceration is almost invariably symmetrical, and in this differs from tertiary syphilis, as it does also in the manner in which the ulceration takes place.

In secondary syphilis, ulceration proper is rarely present except on the tonsils, but on the tongue there will be observed small symmetrical patches denuded of epithelium along the sides and tip. Occasionally, if neglected, these patches deepen into ulcers, with soft irregular edges—

mucous tubercles. Secondary patches, whether mucous tubercles or condylomata, are always symmetrical as to position. In the tonsils, the disease will sometimes extend into the glandular structure. In secondary syphilis the hard palate is seldom affected beyond the ulceration of the mucous membrane,—necrosis of the bone rarely taking place at this stage of the disease.

The ulceration of tertiary syphilis is of a deep spreading character, with irregular and thickened edges, commencing at the mucous membrane, eating through submucous membrane and periosteum, and leading to necrosis of the bone.

In one case, under the care of my colleague Dr. Morell Mackenzie, the second cervical vertebra was laid bare, and considerable hæmorrhage ensued, apparently from the vertebral artery.

The salivation connected with this disease I need not enlarge upon at the present time. When there is any appearance of puffiness in the palate, an examination with the rhincoscope will generally show whether there is any ulceration of the posterior nares going on, and if there is the slightest appearance of this, the patient must at once be referred to the surgeon for treatment. The use of any gargle, inhalation, or local application with the brush, for the purpose of arresting the disease, is quite beyond the domain of even a dental surgeon who devotes himself

specially to the treatment of defects arising from syphilis and other deformities of the mouth.

Further on I shall mention the preparations that I think one is justified in ordering and applying.

The perforations are generally in the median line, though not always, and are more frequently of an oval than round shape, having their long diameter from back to front. Where perforation takes place in the hard palate, there is frequently —in fact, generally—necrosis of the bone on the nasal surface first, gradually coming downwards, so that the actual perforation shown by the destruction of the membranes on the palatine surface appears to have taken place in an incredibly short time, whereas it will probably be ascertained that the necrosis has gone on for some months previously. In one case a patient showed me a portion of the palatine process of the upper maxilla which had come away through the nose three weeks before there had been any perforation through the mucous membrane of the palate.

There is one peculiarity that I have noticed in perforations of the hard palate that I think is worthy of note. There is not simply a loss of substance clearly defined, but the hole is bevelled off at the expense of its palatine surface, thus giving it a funnel-shaped appearance. This con-

dition is usually found in perforations of the anterior third of the hard palate. I have never seen anything like it in the more posterior positions, or in the soft palate. Where there is simply a hole through the soft palate, there is generally, and, I have as a rule found, considerable induration and thickening of the parts.

When the ulceration has gone on to such an extent as to produce cleft of the palate, there are often also present strong cicatrices, drawing the cleft widely apart, sometimes in a symmetrical position, and occasionally to one side of the pharynx. In some cases I have seen the uvula adherent to the back of the pharynx, or drawn down to one side, and almost touching the pillars of the fauces; while in others it has been strained forwards and downwards, and attached by strong bands of flesh to the sides of the base of the tongue. I have seen, but only rarely, cleft of the palate with but small loss of substance, so that the two halves hung down into the pharynx, and occasionally caused great irritation from coming into contact with the epiglottis, whilst still more rarely I have seen entire loss of the soft palate. In the various conditions of palate I am now describing, examination with the rhincoscope will generally show considerable, if not entire destruction, of the opening of the posterior nares, or, speaking more correctly, the partition of the

naso-pharyngeal cavities. The septum will be found much reduced in depth, and the whole of the upper portion of the space furnishing many points of resemblance to congenital cleft-palate.

Above the margin of the cleft, and springing out from the sides of the pharynx, there are frequently seen large nodulated masses of flesh, having sometimes the appearance of polypi, and not unlikely to be mistaken for them. They are, however, simply syphilitic outgrowths, and, once carefully examined, easily recognized again by their hardness to the touch and general consistency. There is one other point only I need touch upon, namely, the general tendency of the soft palate especially, to increase in substance when affected by syphilis.

This I consider worthy of the greatest attention, in order that we may take advantage of it in treating perforation of the velum palati by mechanical means.

Judging from the cases I have treated, perforation of the soft palate is more frequent than that of the hard, while cleft of both hard and soft is more frequent than either. I have treated patients of all ages, from nine to fifty-eight years of age, the largest number being females.

It is well to mention here that, occasionally, after the palate has been restored to such a state as to enable the patient to speak distinctly, still

the voice has an exceedingly disagreeable sound. On examining the throat with the laryngoscope, it will probably be found that this arises from some syphilitic affection of the larynx, such as ulceration of the epiglottis or of one or both of the vocal cords, or adhesion of the two vocal cords to each other in a portion of their free borders, thus impeding vocalization; or there may be, as Dr. Morell Mackenzie has pointed out, paralysis of some of the muscles of the larynx, produced by pressure of cicatrices or injury to a nerve-filament. This I mention to account for want of complete success in some of these cases. Another condition that affects the voice is the deafness often present in these cases, from ulceration or blocking up with growths of the opening of the Eustachian tubes. Some of the instances which I bring forward will show that it is utterly impossible to reproduce the conditions necessary for perfect voice and speech, the difficulties being even greater than in congenital cleft palate. Out of five cases of defects of the palate in patients suffering from hereditary syphilis, one had the typical notched teeth of Mr. Hutchinson, but the four others had not; the diagnosis of the disease was, however, fairly marked. I may say that, as a rule, we seldom find the notched teeth present in cases suffering from disease of the palate or throat.

Treatment.—There is one rule that I think should be strictly adhered to in all cases of perforation of the hard and soft palate, and in most cases of cleft of the hard and soft palate, when it arises from ulceration, and that is, never to introduce anything into the cavity of the perforation or cleft for permanent use. The tendency of the parts is to grow together, and thus gradually obliterate the opening.

Anything rising above the lower margin has the effect of checking this, and ultimately increasing rather than reducing the size of the space. In all these cases it is most essential that nothing shall be done to produce irritation and set up ulceration again.

The surface of the rubber coming next to the part of the palate where there is an opening must be highly polished, so that no chafing may take place. It should be flat rather than convex, so as to offer every inducement to the parts to come together.

I think the earlier these cases are treated the better they succeed, as regards both the general health and the object we have specially in view, of remedying the defect in the palate. The plate preserves the parts from the irritation of foreign bodies, and the membranes are in such a condition as to grow more rapidly than under ordinary circumstances they would do.

I think it safest, and therefore best, to use black rubber for the plates, in order to avoid any possibility of injurious effects arising from the colouring matter used in the manufacture of the ordinary red dental rubber. For cleft and perforations of the velum, it is generally necesary to use elastic rubber, but wherever it is possible to use hard rubber it is more efficient, if it be desired to reduce the size of an opening.

On this account, I sometimes use hard rubber for the front of the palate; then a hinge formed of elastic rubber, and then hard rubber again beyond. This involves a little trouble in making, but the satisfactory results justify the extra labour.

All the cases are held in position by the perfect fit of the plates to the mouth and teeth. It is not well to use bands or metallic collars round the teeth if it can be avoided, and never depend for the support of the pieces on any overlap to be obtained on the upper borders of the palate. In all cases of syphilis I think this is too great a risk to run. When the perforation is in the hard palate, the plate may be made of such a shape as to cover it without unnecessarily encroaching on the roof of the mouth; when the opening is in the soft palate, the rubber should extend about $\frac{1}{8}$ to $\frac{1}{4}$ in. beyond the sides and back of

the cavity. A case of this nature is shown in fig. 73.

When there is a cleft, with the remains of the velum on each side attached to, and continuous

Fig. 73.

with, the pharynx, it is neither possible nor desirable to close the cleft. The object here should be to stimulate the rigid margins and cicatrices into muscular action, in order that the naso-pharyngeal cavities may be separated at will. The hard rubber—for that is generally the best in the first instance, though elastic rubber may be used subsequently—should be fitted to within $\frac{1}{16}$ in.

round the sides, and $\frac{1}{8}$ to $\frac{1}{4}$ in. at the portion coming in front of the posterior wall of the pharynx. The object of the difference in the dimensions of these spaces is that we desire to utilize and increase the lateral contractile power, while we leave the muscles at the back of the pharynx in their normal condition, simply letting them touch the border of the obturator without impinging.

It must be borne in mind that it is most essential for the health of the patient that the mucus of the nose should not be allowed to accumulate to an unnatural degree by the complete closure of the space between the posterior nares and mouth; added to which, it is necessary to avoid the chance of the artificial palate being thrown out of position by the tilting up of the margin coming in contact with the pharynx.

In two cases, where there were no teeth in the upper jaw, the obturator was held in position by means of spiral springs attached to a lower piece. I may state here, that it is advisable to remove any carious or necrosed stumps that may be present in the mouth, as well as any accumulation of tartar; thus reducing the chances of irritation of the gums.

The models are as usual taken in plaster of Paris, but as there are occasionally perforations too large to be covered with gold beater's skin (to

prevent the plaster entering), there is a risk of some considerable portion of it remaining in the opening when the impression is removed. I have, therefore, had constructed an instrument fashioned like a lithotrite, which, by being introduced into the opening, enables the operator to crush the plaster, and then remove it with a pair of tweezers, and afterwards wash away the fragments with a syringe and warm water.

This instrument is shown in Fig 74.*

Fig. 74.

Making the Palate Plates.—For all practical purposes, hard and elastic rubber may be vulcanized together, providing the temperature is sufficiently high to thoroughly cook the hard rubber.

The elastic rubber does not suffer in elasticity from this increased temperature, but in power of resisting the acids of the mouth. Still, it is sometimes desirable to put up with this disadvantage, on account of the other benefits to be derived from the practice. It is necessary when

* Made by Meyer & Metzler, Great Portland Street.

this is done to vulcanize on metallic moulds, either fitted in a flask or held together by a clamp.

The model having been cast in plaster, is moulded in sand and cast carefully in type-metal, in the same way that zinc models are made for striking up gold plates. All that portion of the palate which has been recently the seat of ulceration is well polished, so as to bring it up to a highly finished metallic surface.

Then, instead of mounting up the form of the plate in wax, as you would do on a plaster model, use modelling clay, tolerably dry, that is, as dry as it can be worked conveniently. When it is nicely finished up, and has the form the artificial palate is to have in rubber, whether hard or soft, it is placed by the fire and gradually dried and made warm on the type-metal model; it is afterwards placed in a casting-ring, with sand round it—in the same way that we proceed for making the lead counterpart for plate work—and type-metal poured in. This saves the time and trouble of making a plaster model first, and also insures a more accurate fit of the two castings.

All the surface of this last casting is thoroughly polished, so as to give a smooth surface to the rubber. The rubber is afterwards packed in according to the position that you desire the hard and elastic portions of it to occupy. It is then fixed in a clamp and vulcanized.

The only local application for the mouth I use is tannin and glycerine, this is for the purpose of hardening the parts if they are tender. Any treatment beyond I leave in the hands of the surgeon.

The curative effect of purely mechanical treatment occasionally goes on in cases of perforation of the soft palate in a very rapid manner. In three cases especially, the opening was reduced to one-third the original size in less than two months, occurring in the way shown in the accompanying wood-cuts.

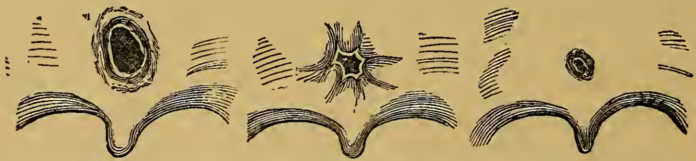


FIG. 75. FIG. 76. FIG. 77.

FIG. 75. Appearance of opening when placed under my care for treatment.

FIG. 76. Appearance after the plate has been worn for two months.

FIG. 77. Appearance of the opening reduced to the diameter shown in wood-cut, twelve months after treatment.

The cuts, Figs. 76 and 77 are one-half the natural size.

The two following cases may perhaps be advantageously reported here, as they are both of a very severe character.

Sophia S——; Aet. 32.—Applied at the Hospi-

tal for Diseases of the Throat for treatment of severe ulceration and loss of parts at the back of the mouth. Nearly the whole of the velum palati had disappeared, the anterior and posterior pillars

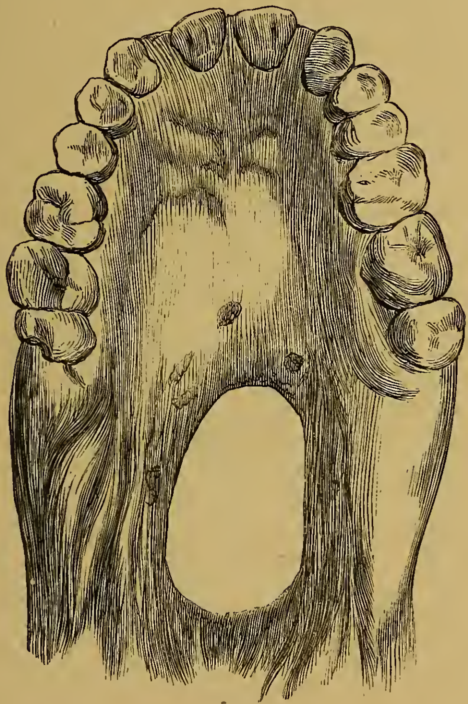


Fig. 78.
Showing cicatrices and old syphilitic scars in front of fissure.

of the fauces were likewise destroyed, so that the roof of the mouth presented the appearance of continuance backwards to the posterior wall of the pharynx, as shown in fig. 78.

In the position that would be occupied by the uvula and central portion of the soft palate, when elevated for dividing the mouth from the nose, there was a large opening of an oval form, about one and a quarter of an inch in extent one way, and three-quarters of an inch from side to side. In swallowing, there was not the slightest movement at the back of the mouth, except in the tongue, which was the only member that could contribute any assistance to the process of conveying the food to the opening into the œsophagus. The back of the mouth was in this way kept in a very irritable condition by the continual lodgment of food in the cleft. From the state of the palate, speech was scarcely intelligible, and the life of the poor woman was in every way a matter of considerable discomfort. Owing also to the great induration of the parts on each side, where the indications of the anterior pillars of the fauces were apparent, I concluded that no power could be obtained to work an elastic velum with any service or comfort, while at the same time there was the consideration to be borne in mind that the disease was still going on, and it was desirable rather to protect the parts from the irritation resulting from food, &c., than to increase the trouble by having an artificial velum, that must necessarily produce some chafing, the mucous membrane being so exceedingly sensitive. A simple hard rubber obtu-

rator was therefore made, partially closing the aperture, and having the inner surface highly polished. This has been very satisfactory in its results.

William T——, engineer; Aet. 37.—In this case the upper maxillary bone was destroyed on the left side from the central tooth to the second molar tooth, following the line of the inter-

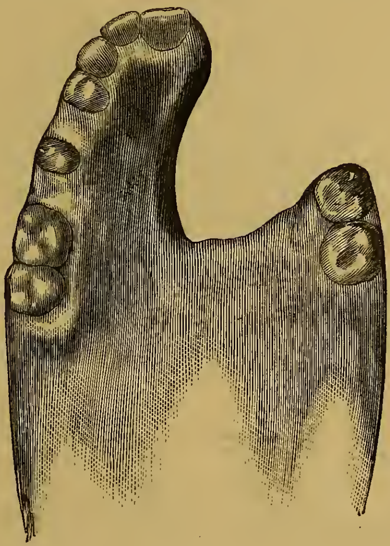


Fig. 79.

maxillary suture, and the connection of the palate-bone with the upper maxilla. The septum of the nose was quite perfect, articulating with the maxillary bone of the opposite side. The turbinated bones of the left side, with the walls

of the antrum, were entirely destroyed up to the floor of the orbit, leaving a gap for restoration by artificial means of considerable extent. The voice was very imperfect, mastication and swallowing very difficult. The appearance of the case is shown in fig. 79.

The instrument that was constructed to remedy these defects is shown complete, ready for wear,

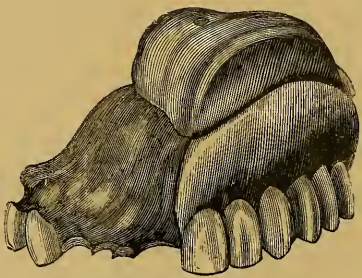


Fig. 80.

The parts connected ready for wear.

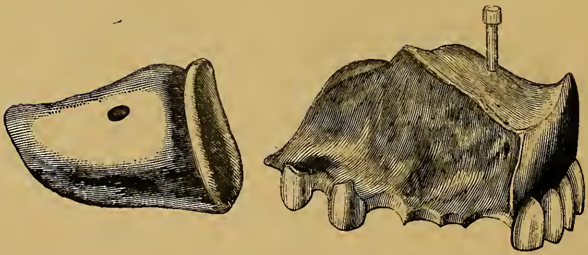


Fig. 81

The parts divided showing the means by which the elastic rubber pad is united to the hard rubber palate plate.

in fig. 80; also with the parts separated, showing how far the hard rubber extended, and where

the elastic india-rubber was connected with it, in order that the more delicate parts might not be irritated.

The means that were adopted were not only satisfactory, but immediate in their results—speech was restored at once to its normal tone and distinctness. Gargling the throat and mouth

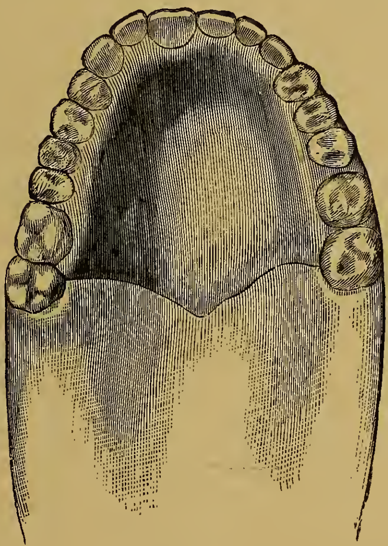


Fig. 82.
The mouth as artificially restored.

(before impossible) were now accomplished with ease, while by the restoration of the teeth to their natural state the patient's appearance was very much improved. The appearance of the mouth after treatment is shown in fig. 82.

It was stated by Mr. Berkeley Hill, in the Monthly Review of Dental Surgery, vol i., 1872, that "the lower jaw appears to be exempt from syphilitic necrosis, as no cases of such disease are recorded hitherto." Out of all the cases of syphilitic necrosis that I have had under my care for the mechanical restoration of lost tissue, I have only had one in which the lower jaw was the seat of disease.

In this instance (a man, aged thirty-six) the anterior portions of both upper and lower jaws were carried away by necrosis; the soft palate had also been destroyed by ulceration, and its free border was attached to the posterior wall of the pharynx; an opening the size of a shilling remaining in the median line, and allowing the passage of air and mucus from the nose. The six anterior teeth of the upper jaw had disappeared with a considerable portion of the adjacent bone. The corresponding teeth had come out from the inferior maxilla with their alveolar processes and part of the jaw itself. When the lips were closed the man had a most ridiculous expression, as a result of the extensive loss of bony tissue. The remaining teeth were sound, and the patient, when he came under my care, was in good health. The defects in both jaws were of course easily remedied by an artificial palate and denture, and in this respect

possessed no special interest; from the rarity, however, of the affection of the lower jaw it is desirable to place the case on record.

CHAPTER XIII.

THE TREATMENT OF GUNSHOT WOUNDS OF THE FACE AND MAXILLÆ.

Without entering into the surgery of the above mentioned subject it will be well to point out the special characteristics of injuries from gun shots and other projectiles of the same description. The old-fashioned round ball was far less destructive than the oblong bullet, now in use. The former generally taking a direct course after perforating the skin; whereas the conical bullet will assume a tortuous line of progress, and ultimately lodge in apparently most unlikely regions. Hamilton, in his "Treatise on Military Surgery,"* mentions the case of a Confederate soldier who was wounded at the battle of Stone's River, Tennessee, he was kneeling and received a rifle ball upon the crowns of the lower incisor teeth, the ball and teeth disappeared, but were subsequently removed from underneath the skin at the top of the sternum. Singularly enough the man

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* Ballière, Broadway, New York. 1865.

never had any inconvenience during breathing or in deglutition. Many others might be given of equal, and some of greater, curiosity in regard to this point.

According to Macleod healing by first intention seldom takes place unless the transit of the projectile has been very rapid, and the patients be of temperate and healthy condition.

In the larger number of cases the course of the bullet is distinguished by extensive sloughing* (the greater, as its force has been less), and after the parts have been put into the best condition possible, gradual healing with granulations. All authorities on this subject agree in the necessity or advisability of leaving as much of the lacerated flesh and splintered bone as it is possible to place in fair position, as from the extreme vascularity of the face, there is much more hope of their retaining their vitality than in other regions of the body where the blood supply is not so great, it being generally observed that exfoliation is much more rare in the face than in

* "Notes on the Surgery of the Crimean War." Churchill. 1858. The following works may also be consulted on this subject:—"Williamson's Military Surgery." Churchill. 1863. "Garretson on the Surgery of the Mouth and Jaws." Lippincott and Co., Philadelphia. 1869. "Catalogue of the Surgical Section of the United States Army Medical Museum." Washington. 1866. "Heath on the Jaws." Churchill. 1868. "Elliott. Gun Shot Wounds of Mouth." "New York Medical Journal," March, 1879. Appleton, New York.

other parts. Where the larger muscles of mastication are severely injured there occurs a good deal of contraction during the process of healing. It is hardly necessary to point out the extreme danger of primary and secondary hæmorrhage from gunshot wounds of the face.

Macleod has pointed out a source of trouble and danger in cases of wounds opening into the cavity of the mouth that I have not found in other works on the subject. It is the liability of the patient to suffer from swallowing the secretion from the wound, he mentions one case that terminated fatally in consequence of the impossibility of keeping the mouth perfectly clean and free from such discharge as was emptied into the buccal cavity. Without leaving the domain of the Dental Surgeon, I would venture to suggest to my surgical friends whether they might not use with advantage a Dental saliva pump in order to ensure thorough cleanliness. In the partial or entire loss of the lower jaws there is, of course, great deformity, but it does not end there, for if no mechanical appliance be fitted within a short time of the healing up of the parts, there also arises a deformity of the upper jaw in which the arch of the teeth is contracted in the region of the bicuspids, giving the maxilla the appearance (as one writer describes it) of an hour glass.

Where only a portion of either the upper or lower jaw is destroyed there is very soon considerable contraction and approximation of the parts towards each other, thus increasing the deformity that already exists from loss of substance.

These special features in regard to injuries received from gun shots point out to us certain obvious and practical conclusions.

Plastic surgery under certain conditions can do a great deal to remedy the deformities arising from severe wounds produced by the different kinds of projectiles in use, especially when, as is sometimes the case, there remains a large amount of sound healthy substance; and these are always capable of a good deal of trimming up at a later period, when the surgeon has obtained indications of the deformity that is likely to arise purely from citatrical tension.

There was a noteworthy instance of this kind under the care of Sir William Fergusson, at King's College Hospital, where a lad having shot away a large portion of the right side of the face, a gap remained, from which the saliva constantly dribbled. Ample substance was left, however, for making the surfaces raw, and reforming the angle of the lips by bringing the parts well together with hare-lip pins and suture. Fergusson pointed out at the time the benefit of

the fullness of the parts, and at the same time expressed his reasons for not removing what appeared at that time a great redundancy of material, having in view some further operation at a future time. I do not propose to enter into the treatment of these especially severe cases, except as the work of the surgeon may be assisted and perfected by the skill of the Dental Surgeon.

Splints fashioned to the shape that the parts are required to assume, will be found of much service in a great many instances. They may be best made of black vulcanite, and in this material they are very light and cause but slight inconvenience; they should be well perforated to give the same amount of ventilation as if ordinary bandages were used, being lined with antiseptic dressings. If they are made in a good shape, they give a corresponding form and consistence to the parts that have just been subjected to a plastic operation.

The forms of these splints admit of numberless modifications, according to the conditions and situation of the region to be operated upon. It is in most instances necessary to take a model of the part first by means of plaster if possible, or if not in the ordinary way with that substance, by means of canvas or cotton rag dipped into thin plaster and laid carefully on the flesh, having first taken the precaution to oil the skin, and if

plaster is not available, then rag dipped into melted wax or composite candle, and allowed to harden again, being slightly warmed and softened before being pressed down to take an impression of the side of the face, or any portion of the jaws. By any of these ways a rough cast can be obtained of the part to be fitted with a splint, and a model made from it on which the splint itself can be moulded and finished. When, however, it is possible to take a full plaster cast in the ordinary way, a much more perfect result is of course obtained. These splints by their firmness, cleanliness, and lightness, are much better adapted to this particular class of cases, where the parts are in healthy condition, than straps and bandages alone, which are so much more liable to displacement, and at the same time do not furnish such a perfect mould for the reformed feature.

No branch of Dental Surgery gives the opportunity of a greater amount of invention and mechanical skill than the treatment of gunshot wounds of the jaws. The conditions are so various and, apart from certain broad principles, must be treated on such different plans, that it is impossible to give instructions that shall apply to the treatment of every case. I shall first refer to the best means of obtaining a perfect model of the parts that have been injured.

When the opening of the mouth and the general state is such as to admit of an ordinary tray being used, no difficulty will be found and no instruction in this place is necessary; occasionally, however, the opening of the mouth is too small, and the impression must be taken in parts or broken before it can be removed out of the mouth. This sometimes requires that a very slight layer of plaster should be applied; in order to give this greater strength, however, very thin, and fine old muslin may be used, dipped into plaster and put in position in the mouth. This strengthens the impression to a remarkable extent, and enables us to remove it without having it come to pieces; if space admits two or three layers of the muslin can be manipulated in the mouth by means of a spatula very much better than a simple mass of plaster introduced in a thick tray, while, if carefully applied, it gives a very satisfactory result. If it is required to take the model in two parts an impression plate, such as I have described, in Chapter IX., must be used.

One other mode of obtaining an impression remains to be mentioned, and that is, by means of a large mouthed syringe. It not unfrequently happens that there is no other way of taking a model in plaster of Paris, especially if it be borne in mind that plaster to be successful in its application should be used only of the consistency of

cream. It is in gunshot wounds especially that it is necessary to take impressions of parts the most singularly deformed and distorted from their natural conditions. The syringe filled with liquid plaster can be held in any position, and the contents projected accurately into any portion of the maxillary region of which we desire to obtain a mould. The removal and joining of broken fragments can always be accomplished by any one with a fair amount of manipulative skill, and from the fact of their edges being sharply and well defined the result is in most cases highly satisfactory.

Passing from this subject to that of the restoration of the parts, it may be stated in general terms that the material should reproduce as far as possible the nature and texture of the tissue lost; still there are frequently mechanical difficulties in the way of accomplishing this. Thus, in the lower jaw, it is not unusual to have a portion shot away in the shape of an inverted V. Here elastic rubber is of immense value; by its means the gap can be filled up perfectly, and the utility of the jaw restored. For this purpose (taking the present as a fairly representative case), the elastic rubber must be fitted into the gap first, and have two holes directed in oblique directions from each other, into which pins may be fitted.

When this goes into its place accurately, a hard rubber piece should be fitted on to it in such a way that it can be connected by its pins with the elastic rubber, when it is in the mouth, and form but one piece. It can be, of course, separated also at the will of the patient, and thus facilitate removal from the jaw, and at the same time, by the portion that fits into the dovetail being of elastic rubber, give a more accurate reproduction of the part than if only hard rubber or gold, connected by means of springs, were used. Whatever is used should be so made that it can be taken out and put in again without much trouble. If there is not room for rubber or plate and flat teeth, in reproducing any loss of parts in the jaws, or when it may be desirable to contrive something to modify an exceedingly unsightly deformity without great loss of substance (as not unfrequently occurs), then continuous gum work is of great service; and when the space is very small indeed, thin sheet iron or platina may be shaped up to the required form and then enamelled with Allen's preparation, in order to represent the desired parts. In the treatment of all the soft parts it must be remembered that they change to a great extent by contraction from cicatrization, and that according to the skill of the operator this will be turned to account, or act in opposition to his efforts at alleviation of his

patient's distress. With the means we have at our command at the present day, there is no case that is not capable of improvement by judicious mechanical treatment, and at the same time the more permanent work of the surgeon may be rendered certain of success to a greater extent.

CHAPTER XIV.

THE BEST MODE OF TREATING CONGENITAL CLEFT PALATE.

I have endeavoured in the previous chapters to confine myself to a simple statement of facts. Although the treatment has always been mechanical, it has been, as far as possible, based on physiological principles.

Satisfactory as the results of the past have been, I do not feel at all disposed to say that we have arrived at perfection in this departmant of Dental Surgery. We have yet to obtain a material having a less specific gravity, and a greater power of resistance to the acids of the mouth, than those which we at present possess.

An extended field of observation has led me to the conclusion, that the weight of artificial obturators is often a source of great discomfort to the wearer.

I trust at no very distant period, that we may have some better means of teaching in a more efficient manner, those who have defective speech,

produced by physical, rather than functional causes.

Much as I believe in the soundness of that system of curative Dentistry introduced in recent times by Dr. Norman Kingsley, and followed out by others besides myself, I am by no means wedded to my belief to such an extent as to undervalue the merits of the surgical operation for congenital cleft palate. In a previous portion of this volume, I have pointed out a fact, which I would again draw attention to, that it was on the discoveries made by Sir William Fergusson, that Snell, in 1848, based the construction of that instrument of which Kingsley's is but a more perfect example. I am fully prepared to admit, that provided the conditions of the parts be suitable, the surgical operation being done once for all, is superior to any mechanical contrivance, that must necessarily be renewed from time to time. The question, therefore, turns on what is a suitable condition of the parts for operation.

They may be very briefly stated :—

(1) A sufficient substance on each side of the cleft to admit of freely paring the edges.

(2) An amount of mobility that will admit of the free borders easily approximating.

(3) A sufficient length of the central portion of the cleft palate, when united, to produce

perfect closure between the naso-pharyngeal cavities.

I believe all physiologists and surgeons will agree with me, that unless these conditions be present, it will be impossible, after the operation is completed, for the patient to acquire perfect speech. If the deformity be such, that after the cleft is closed, the free border of the soft palate cannot be brought into contact with the posterior wall of the pharynx, it is vain to expect that a perfect articulation will be attainable by the person operated upon.

Holding the views I do in reference to the two modes of treatment, the object of my experiments with reference to Cases I. II. III. and IV., Chapter XI. will be more readily understood.

CHAPTER XV.

EXPLANATION OF THE ILLUSTRATIONS ON STONE.

Plate I.—Fissured palate and alveolus.

The fissure through the alveolus is on the patient's left side. The vomer is seen articulating with the right palatine process of the upper maxilla. The bifurcated uvula is seen in contact with a stem of glass near the lower part of the drawing.

Plate II.—The same case, the bones having been prepared and dried, the position of the vomer in relation to the adjacent palatine process shows how such a case as this may be mistaken for one of "double cleft palate."

Plate III.—Dissection of a cleft palate; copied from Fergusson's Practical Surgery.

The plate represents the posterior nares and upper surface of the soft palate.

a. The levator palati; the dark line shows where it should be cut across.

b. The inner bundle of fibres of the palato-pharyngeus forming the posterior pillar

of the fauces; the black line indicates the place for division.

c. The palato-glossus, with the mark for incision, if one should be deemed necessary.

The tonsil lies between these two muscles.

d. The tensor palati, the cartilaginous extremity of the Eustachian tube is in front of this letter.

e. The posterior extremity of the inferior turbinated bone.

f. The septum.

g. *g*. The uvula on each side stretched apart.

Plate IV.—Cleft palate in a child as seen ten weeks after birth. I had the opportunity of seeing this child through the kindness of Mr. Berkeley Hill, under whose care the infant was placed. The deformity was of a most severe character, and after keeping the little babe alive by means of an artificial palate and feeder for seven weeks, it at last died; it never at any time weighed more than 4½ lbs., and at death weighed 3½ lbs. As will be seen by reference to the plate, there was little more than the alveolar ridge developed, and at the same time the infant was so exceedingly delicate, that from the first but small hopes were entertained of saving its life. The only other case of equal severity that I have seen is in the museum of King's College, a drawing of which

I have been kindly allowed to make by permission of the Council.

This is shown in fig. 83.

Fig. 83. Skull of a Fœtus with cleft palate.

Plate V. Fissure in hard and soft palate as seen in a child six weeks after birth. The drawing reproduces the subject the natural size.

Plate VI.—After Vrolik, Tabulae ad illustrandum embryogenesin hominis et mammalium, tam naturalem quam abnormem. Amsterdam, 1845.

Figs. 6 and 7 are illustrations of the same case showing fissure of the palate, double fissure of the alveolus, and excessive projection of the intermaxillary bone. This case clearly demonstrates the fact that, although you may have double cleft of the alveolus, you cannot have a true double cleft of the palate, for although the vomer shows

as a divisional line in the centre of the palatine fissure it must be borne in mind that the vomer does not in any sense contribute towards the formation of the palate, and hence the central position occupied by the vomer in the drawing, is simply to be regarded as a division occurring on a higher plane than the palatine processes of the maxillary bones would occupy, and thus forming the nasal partition only, and not a central part of the palate.

Fig. 8 is an illustration of the exceedingly rare deformity caused by the entire absence of the inter-maxillary bone. In the Teratological Section of the Museum of the Royal College of Surgeons is another example, numbered 155. This is, I presume, the case referred to by Vrolik, see *ante* p. 40.

Fig. 9. Fissured palate, double fissure of the alveolus, and uni-lateral arrest of development of inter-maxillary bone. This deformity is unique, so far as my own investigations and observations enable me to give an opinion. It will be noticed that in this instance the developed half of the inter-maxillary bone does not extend beyond the range of the normal dental arch.

Plate VII.—After Von Ammon. Die angeborenen Chirurgischen Krankheiten des Menschen. Berlin, 1842.

Fig. 10. Irregular development of the central

portion of the upper lip, illustrating the manner in which double hare-lip occurs, and indicating the general lines of development in the anterior part of the skull.

Fig. 11. Fissured palate and double hare-lip, the inter-maxillary bone carried beyond the normal dental arch by the increased length of the vomer.

Fig. 12. Perforation of a congenital origin in the median line of the palate, owing to arrest of development of a part of the palatine process of the maxillary bones.

Plate VIII.—Showing growths found in the naso-pharyngeal cavities of patients with congenital cleft of the palate.

Fig. 13. W. B., æt. 68. Unsymmetrical cleft, associated with hare-lip. Two small bodies, dense in structure, attached to the vomer.

Fig. 14. J. H., æt. 16. Complete fissure with double hare-lip (treated soon after birth). Two larger bodies attached to turbinated bones, and less dense in structure than case 1.

Fig. 15. E. T., æt. 17. Cleft of soft palate and portion of hard palate. Two large growths attached to upper part of vomer, and so completely blocking up the cleft as to render the voice quite intelligible.

Fig. 16. J. A., æt. 19. Complete fissure of palate with double hare-lip. In this case the

growth was of a cystic character and on one side only, being attached to turbinated bone, and shrivelled up after it was freely treated with "London Paste."

Fig. 17. E. A., æt. 7. Growths placed anteriorly in the nose, only to be seen by the aid of the Rhinoscope.

Plate IX.

Fig. 18. Congenital cleft in the soft palate.

Fig. 19. Congenital cleft extending through soft and posterior fourth of hard palate.

Figs. 20 and 21. Congenital cleft of soft and posterior third of hard palate.

Plate X.

Figs. 22, 23 and 24. Further examples of congenital cleft of the palate.

Plate XI.

Fig. 25. Congenital cleft of soft and posterior half of hard palate, associated with hare-lip, but not fissured alveolus.

Figs. 26 and 27 are examples of congenital cleft palate with edentulous gums.

Plate XII.

Fig. 28. Congenital cleft of soft and hard palate, and double fissure of the alveolus and hare-lip; the inter-maxillary has been removed in early life.

Figs. 29 and 30. Examples of congenital cleft of the hard and soft palate.

Plate XIII.

Fig. 31. Congenital fissure of the soft and part of the hard palate, with indications of the diminished growth of tissue in the anterior part of the palate.

Figs. 32 and 33. Further examples of double fissure of the alveolus, the two upper maxillary bones being approximated, and coming into contact in the median line.

Plate XIV.

Figs. 34, 35 and 36, are examples of complete fissure through hard and soft palate, with fissure of the alveolus on the left side only.

Plate XV.

Fig. 39 a further example of left side fissure of alveolus associated with palatine cleft.

Figs. 37, 38 and 40 are cases of fissured alveolus occurring on the right side of the patient's mouth, with cleft of hard and soft palate.

Plate XVI.

Figs. 41, 42, 43 and 44, examples of loss of tissue in the maxillary and palatine regions arising from syphilitic ulceration.

Plate XVII.

Fig. 46, shows destruction of anterior portion of upper jaw from enthetic disease.

Fig. 45 shows an artificial appliance made of hard vulcanized rubber for remedying the defect.

Fig. 47. extensive loss of bone and alveolus in the upper jaw of a specific origin.

Plate XVIII.

Figs. 48, 49 and 50 are examples of the destruction of the entire outline of the upper jaw from necrosis and ulceration.

Plate XIX.—Affections of the Palate arising from Inherited Syphilis.

Fig. 51. R. M.; aet. 18.—Cleft of hard and soft palate, and perforation of hard palate; the cleft is divided into two by a narrow band on the one side.

Fig. 52. W. G., aet. 20.—Perforation of hard palate; the bones of the nose had been destroyed to a very great extent, so that the depth of the palate was increased by loss of a portion of the floor of the nasal cavity. The free border of the soft palate (the whole of which was drawn upwards and forwards) was attached to the posterior wall of the pharynx, so as to completely shut off all communication with the nose.

Fig. 53. Shows (but very imperfectly) the typical notched teeth described by Mr. Jonathan Hutchinson, as characteristic of this disease, but rarely seen in connection with any loss of the palate.

Fig. 54. Shows the epiglottis of the same patient, bifurcated, whether congenital, or from ulceration, could not be decided.

Fig. 55. W. M., aet. 12.—Perforation of hard palate, cleft of hard and soft palate, and attachment of the lateral fibres to the sides of the pharynx.

Fig. 56. M. R., aet. 8.—Extensive destruction of soft palate, and extreme tension of the margins towards the sides of the pharyngeal wall.

Plate XX.—Syphilitic Affections of the Palate.

Fig. 57. Perforation of hard palate, septum of nose seen through the opening. Tertiary syphilis.

Fig. 58. Cleft of soft palate involving portion of hard palate; the sides of the cleft are continuous with the sides of the pharynx. Tertiary syphilis.

Fig. 59. Very severe form of cleft of hard and soft palate, showing out-growths attached to the side of the pharyngeal wall. Tertiary syphilis.

Fig. 60. Cleft of soft palate, showing extreme tension from old cicatrices, the margins of the cleft being attached to the sides of the base of the tongue. Tertiary syphilis.

Plate XXI.

Figs. 61 and 62 are sketches of cases of inherited specific disease, and are given here in order that certain characteristics may be noted. These special features are the square forehead, the fixed stare, the fine brittle hair, the opaque complexion, the scars around the angles of the mouth, and in the elder patient the de-

pressed bridge of the nose from destruction of the nasal cartilages and bones.

Fig. 63 is a case of Lupus, involving the soft tissues of the face and the intermaxillary region of the upper jaw.

Plate XXII.

Figs. 64, 65 and 66 are illustrations of three cases in which staphyloraphy has been performed but the cleft has remained unclosed in the hard palate. This region was of course easily restored by means of an artificial palate.

Plates XXIII., XXIV. and XXV.

Figs. 67 to 86 inclusive are illustrations of the various forms of elastic rubber vela used by the author.

Outline Diagrams.

26. *Greek.*—Sectional tracings of skull showing correspondence of form.

27. *Chinese.*—The same.

28. *Uninitialed.*—Longitudinal tracings of two skulls.

29. *Uninitialed.*—Transverse and longitudinal tracings of skull.

30. *F. S. æt.* 24.—Skull tracings showing transverse, longitudinal and circumferential outlines in a case of cleft palate, indicating the general symmetry of the skull.

31. *C. D. æt.* 21.—Similar outlines but showing flattening on the left side of the cranium.

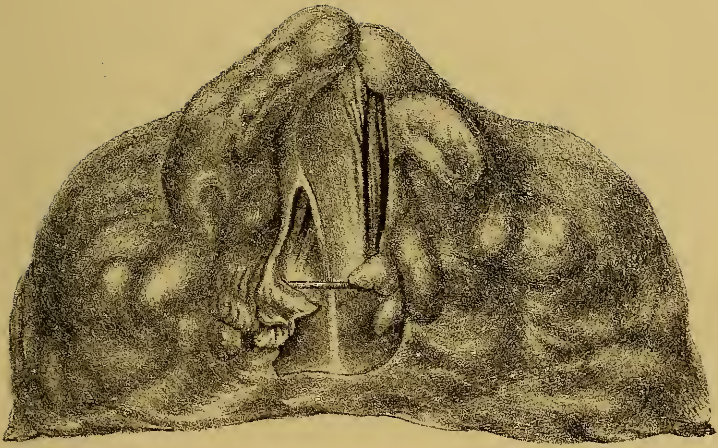
32. *M. G. æt.* 15.—Similar outlines but symmetrical skull.

33. *J. C. æt.* 11½.—Palatine and skull tracings, showing deformed palate, and left sided flattening of cranium.

34. *H. T. æt.* 21.—Palatine and skull tracings, showing palatine deformity and flattening of left side of cranium.

35. *L. W. æt.* 37.—Skull tracings showing irregularity of growth in anterior part of skull associated with arrested growth of upper jaw. See fig. 33, p. 73.

Plate 1.



West, Newman & Co. lith.

Plate 2

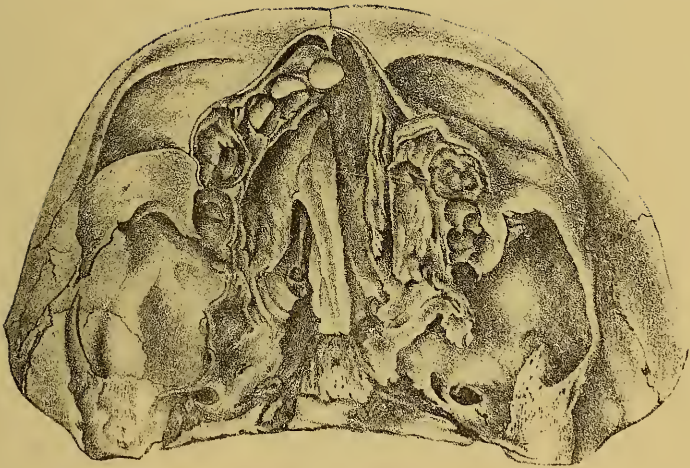


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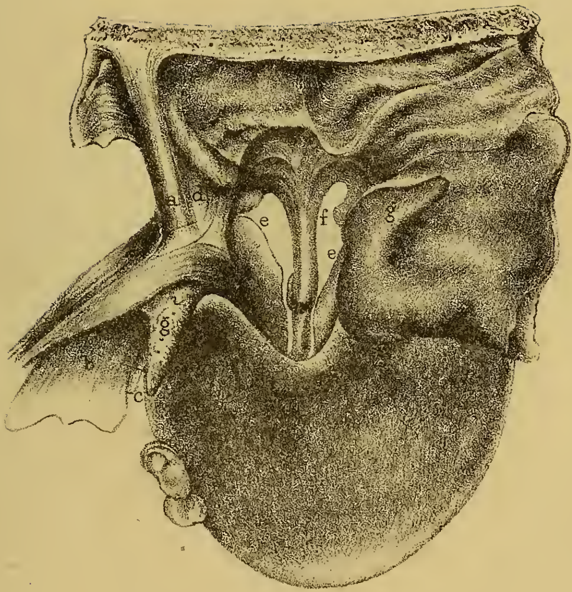
Plate. 3.



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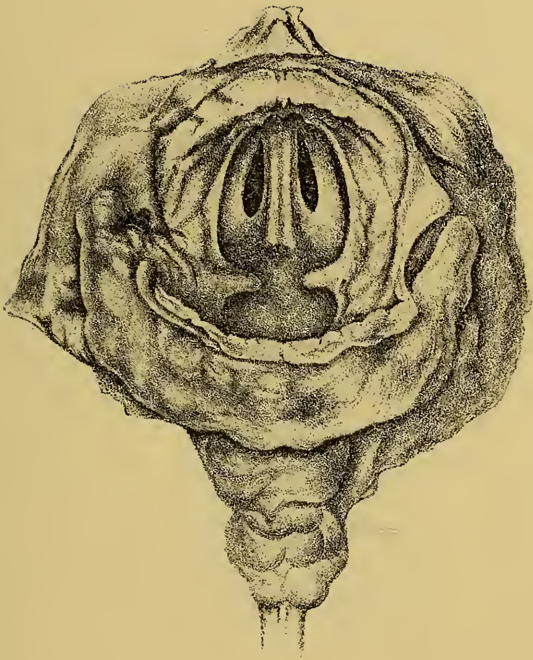


West Newman & Co. lith.

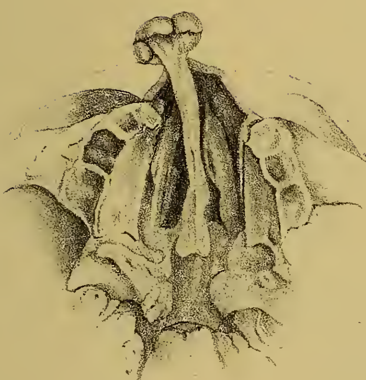
SPLIT PALATE OF CHILD TEN WEEKS AFTER BIRTH
TAKEN FROM A PREPARATION IN THE AUTHOR'S POSSESSION

Plate 5.

CLEFT PALATE OF CHILD SIX WEEKS AFTER BIRTH.
TAKEN FROM A PREPARATION IN THE AUTHOR'S POSSESSION.

West, Newmn & Co. lith.

6.



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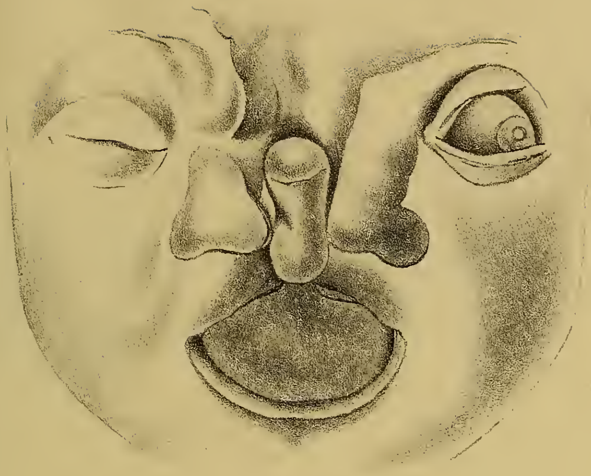
After Vrolick,
H Knight del et lith.

West Newman & C° imp



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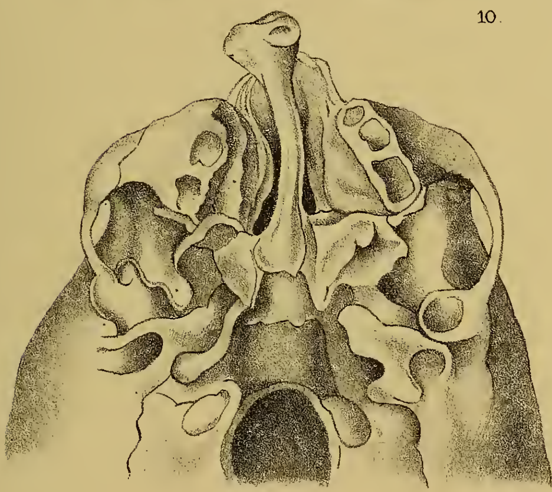

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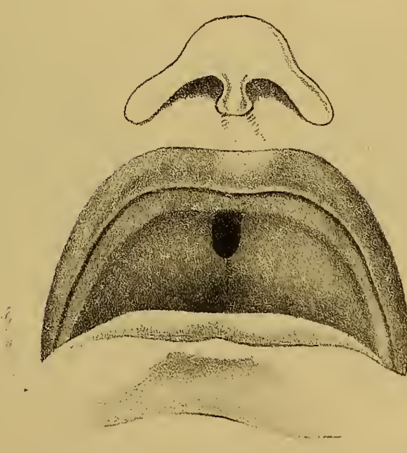

12.

From the Author's Collection.
H. Knight del. et lith.

West, Newman & Co. imp.

Plate 8.

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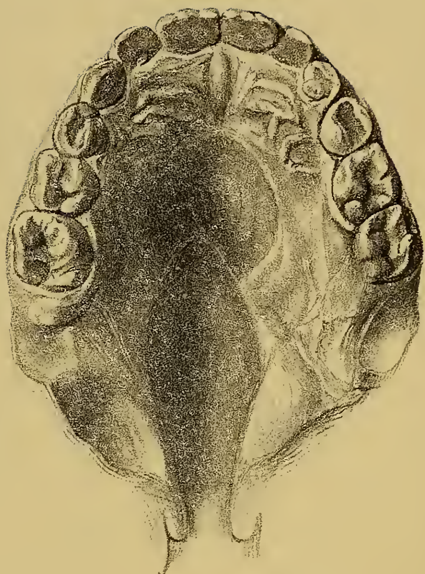
From the Author's Collection.
H. Knight del. et lith.

West, Newman & Co. imp.

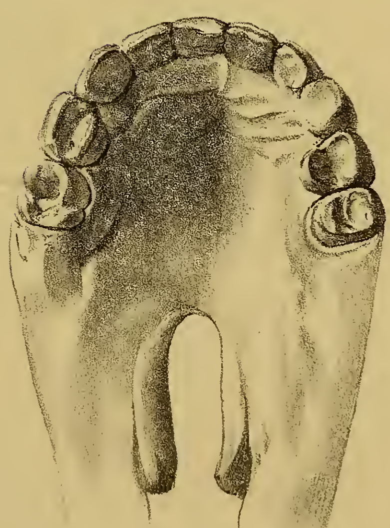
Plate 9.

19.



21.

20.



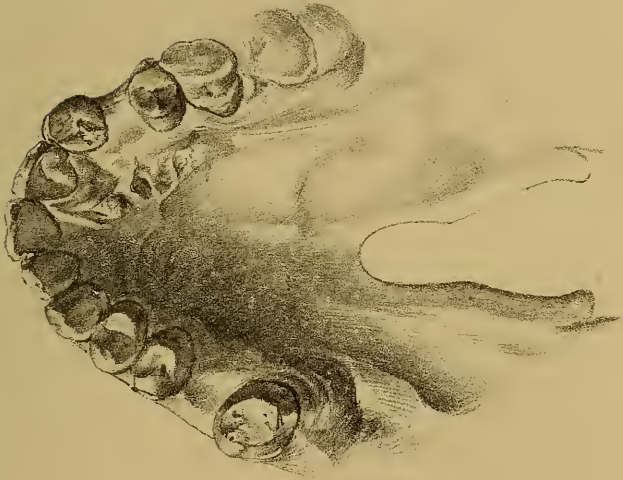
18.

From the Author's Collection
H. Knight del et lith.

West Newman & Co. imp.

Plate 10.

22



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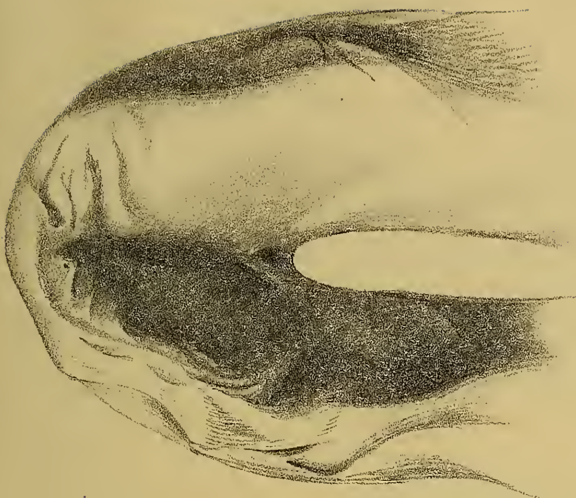
From the Author's Collection.
H. Knight del. et lith.

West Newman & Co. imp.



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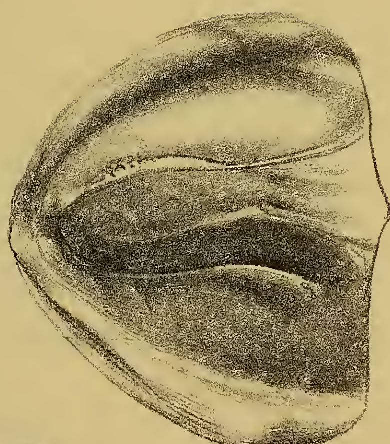

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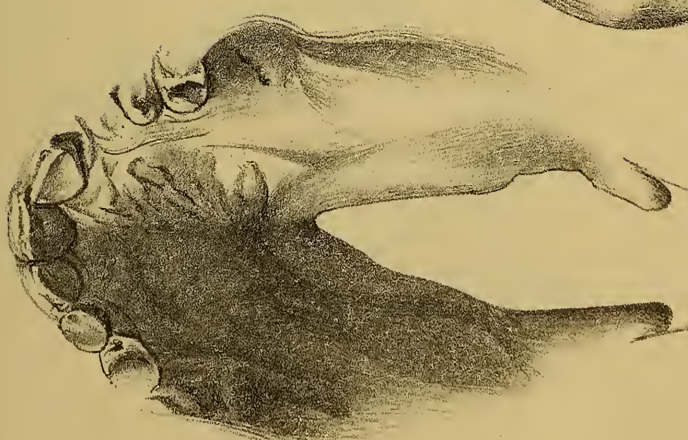


25.

From the Author's Collection.
H. Knight del. et lith.

West Newman & Co imp.

30.

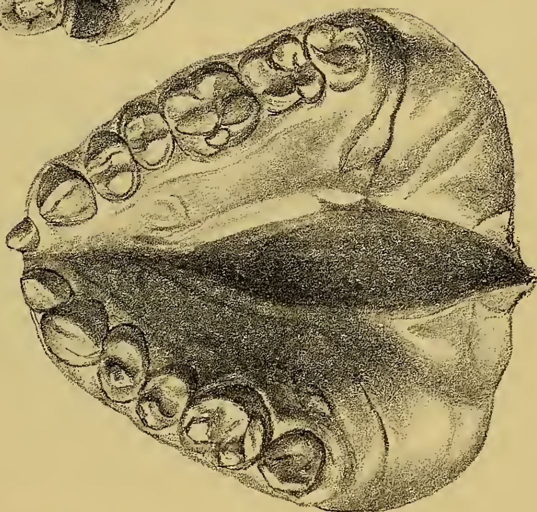
29.

28.

From the Author's Collection
H. Knight del. et lith.

West Newman & Co imp.

33.



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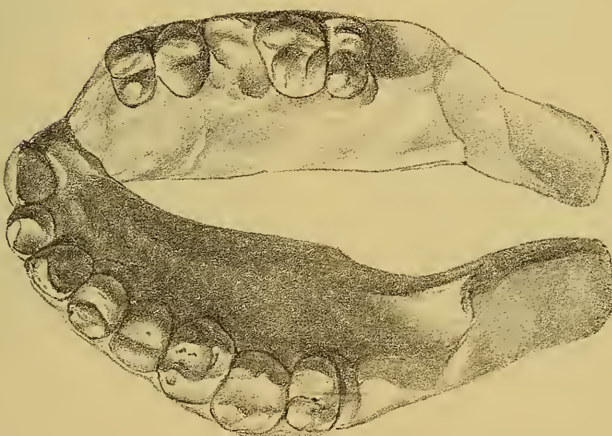
31.

From the Author's Collection
H Knight del. et lith.

West, Newman & Co imp

Plate 14.

36.



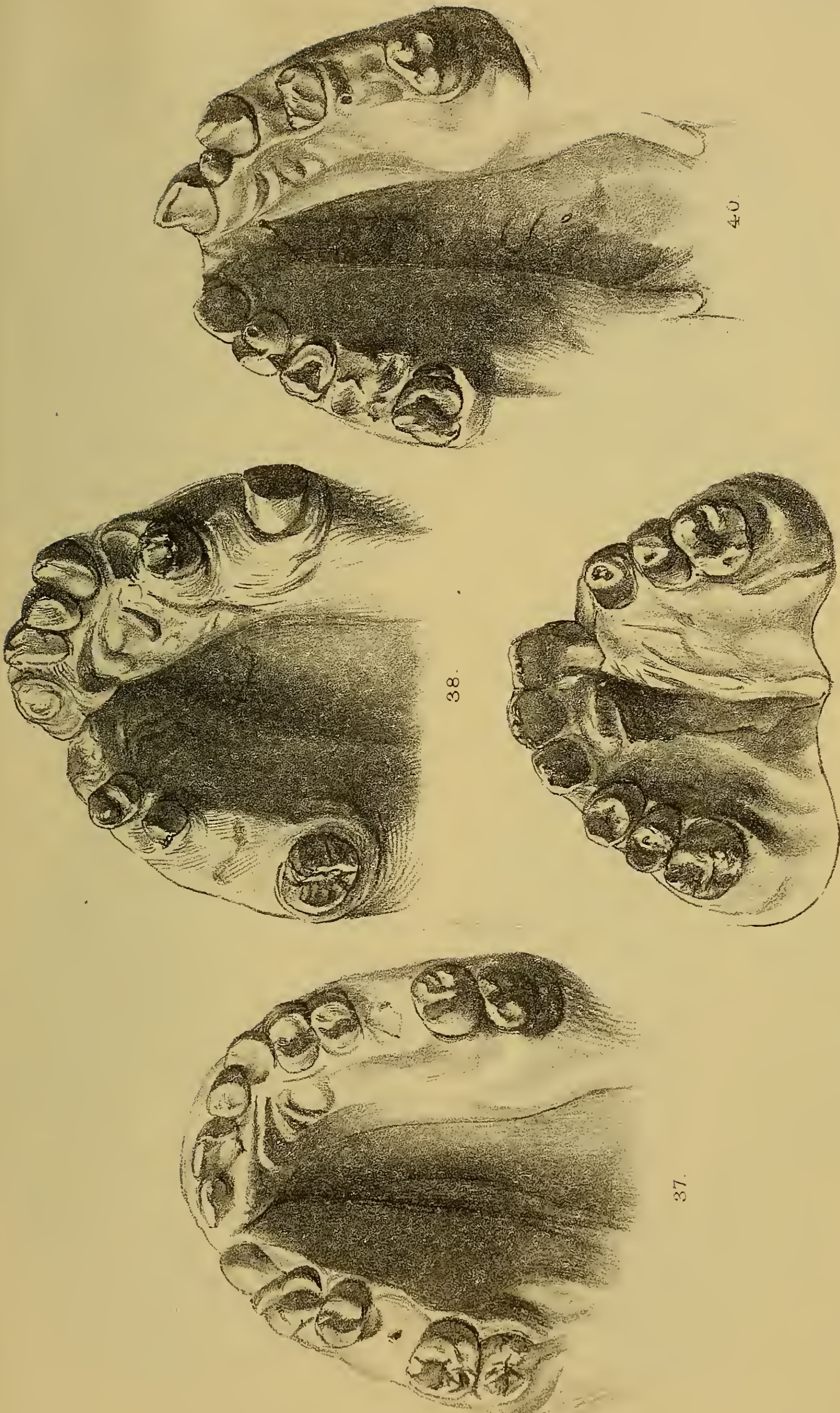
35.

34.

From the Authors Collection
H. Knight del. et lith.

West Newman & C° imp

Plate 15.



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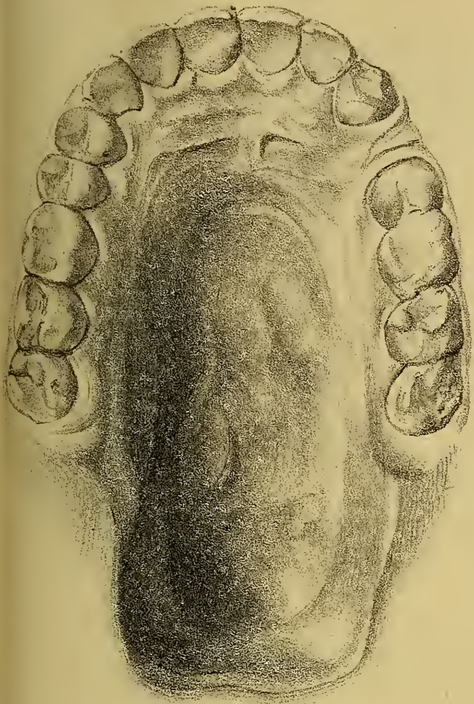
37.

From the Author's Collection
H. Knight del. et lith.

West, Newman & Co imp.



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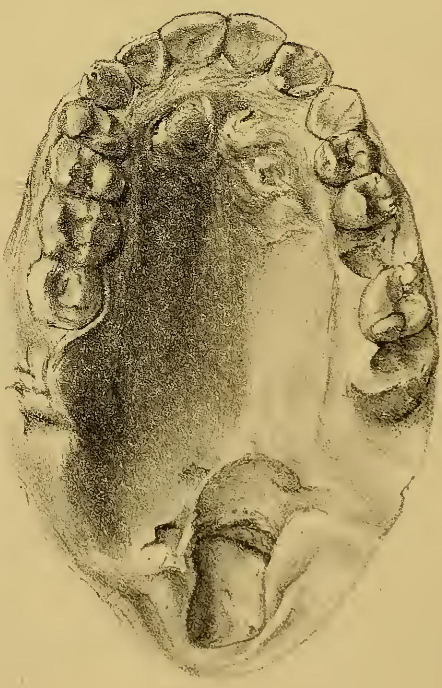

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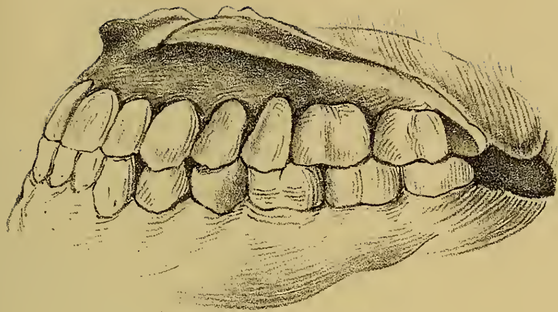
From the Authors Collection.
H. Knight del. et lith.

West, Newman & Co imp



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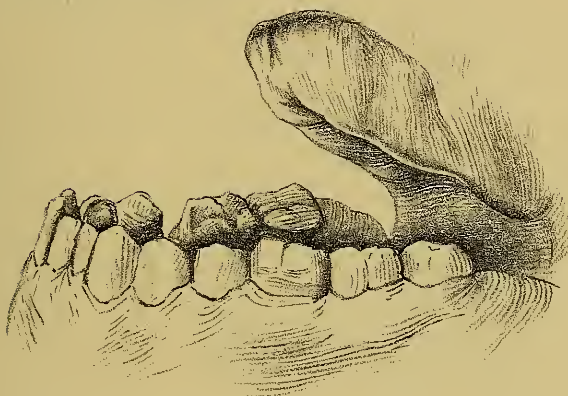


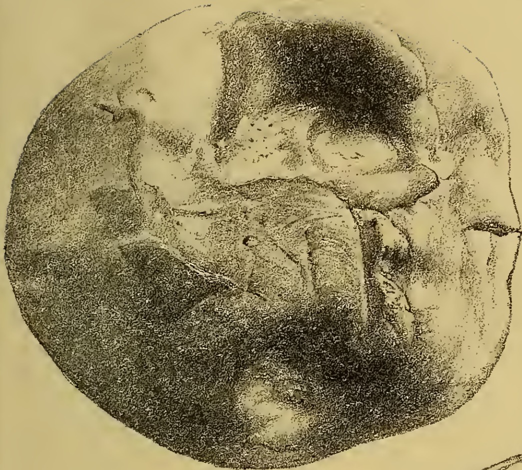
46.

47.

From the Author's Collection
H. Knight del. et lith.

West, Newman & Cº imp

Plate 18.



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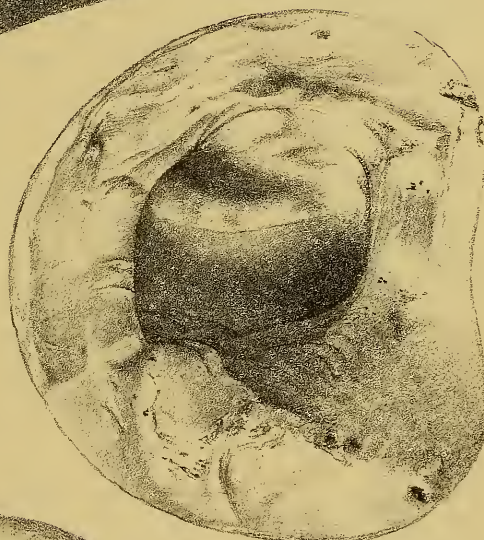


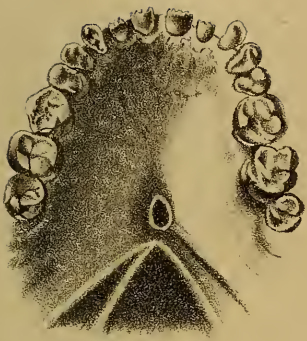
49.

48.

From the Authors Collection,
H. Knight del. et lith.

West Newman & Co. imp.

Plate 10.



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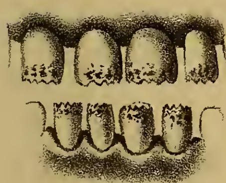

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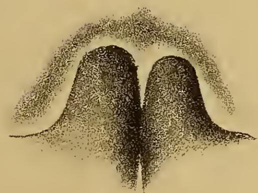

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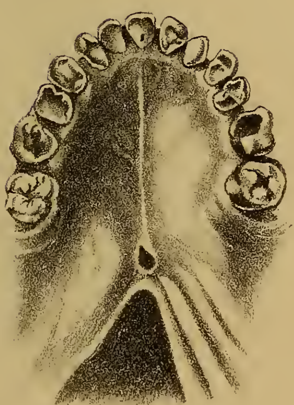

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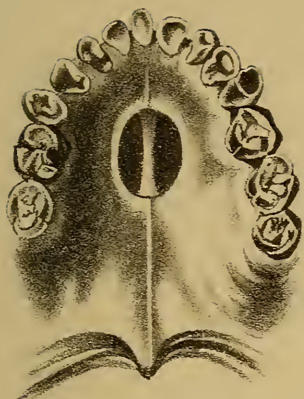
From the Author's Collection.
H. Knight del. et lith.

West Newman & Co. imp.



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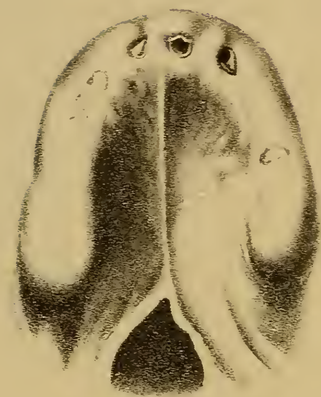

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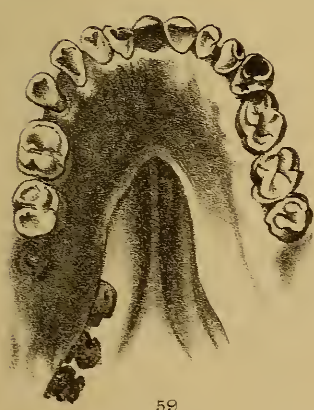


59

60

From the Author's Collection.
H. Knight del et lith.

West Newman & Co. imp.

62.

63.

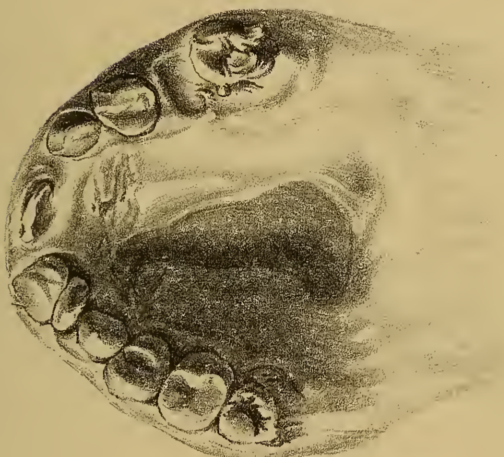
61.

From the Authors Collection.
H. Knight del. et lith.

West, Newman & C° imp

Plate 22.

65



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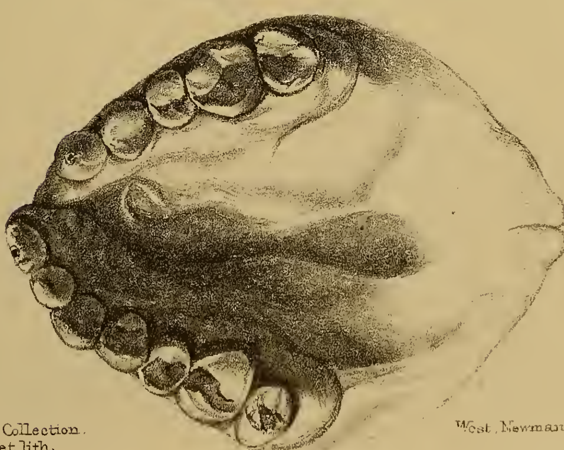

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From the Author's Collection.
H. Knight del. et lith.

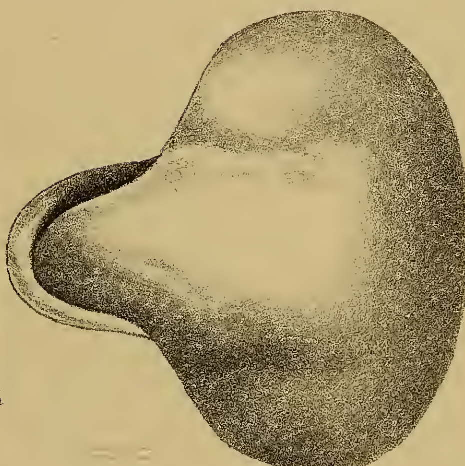
West, Newman & Co. imp.

Plate 23.


70


71


67


68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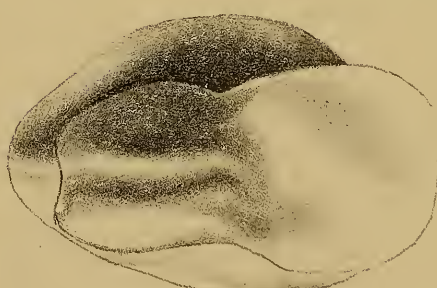
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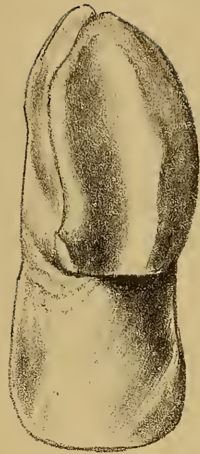
From the Author's Collection.
H. Knight del. et lith.

West, Newman & Co imp

Plate 24.

75



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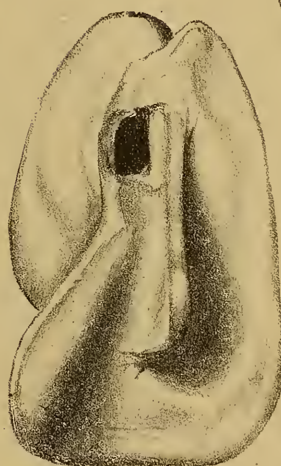

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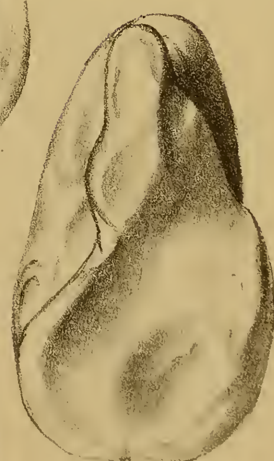

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78

From the Author's Collection.
H.Knight del et lith.

West, Newman & Co. imp

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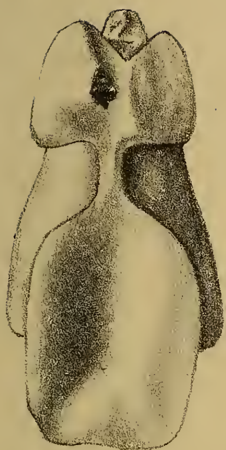

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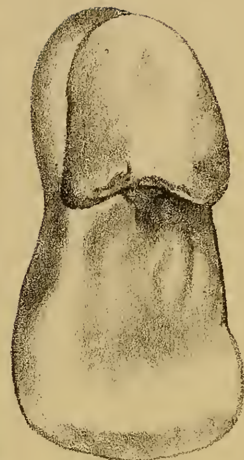

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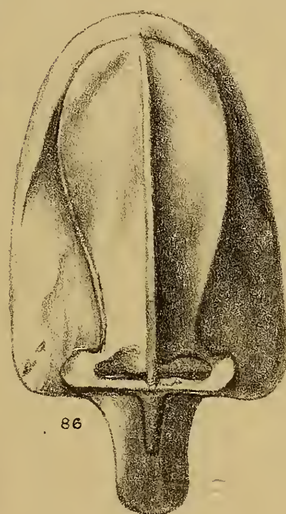

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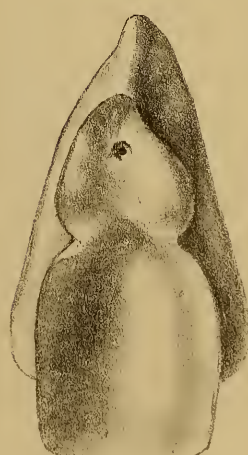
83

82

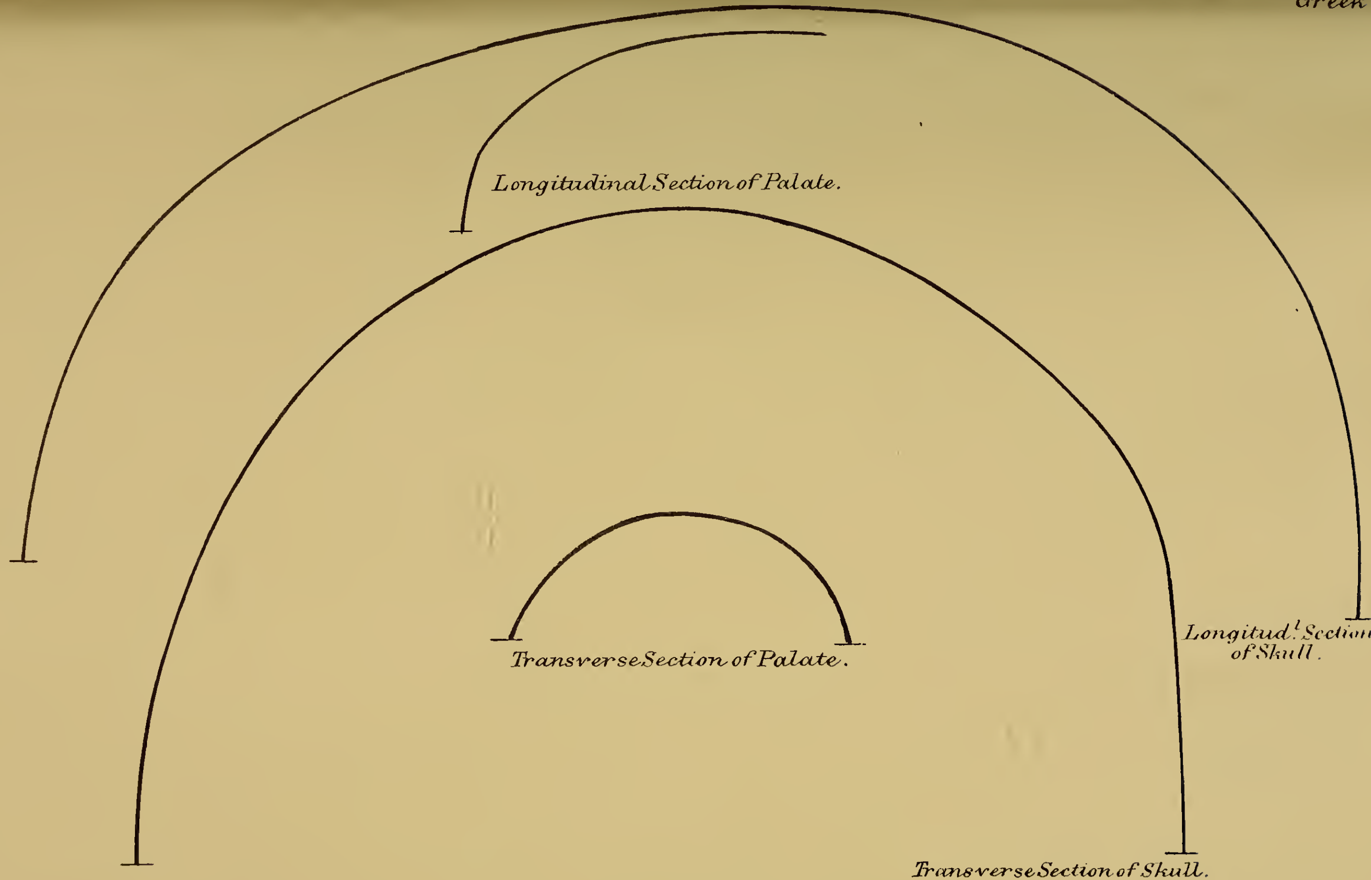


84

From the Author's Collection.
H. Knight del et lith.

West, Newman & Co imp

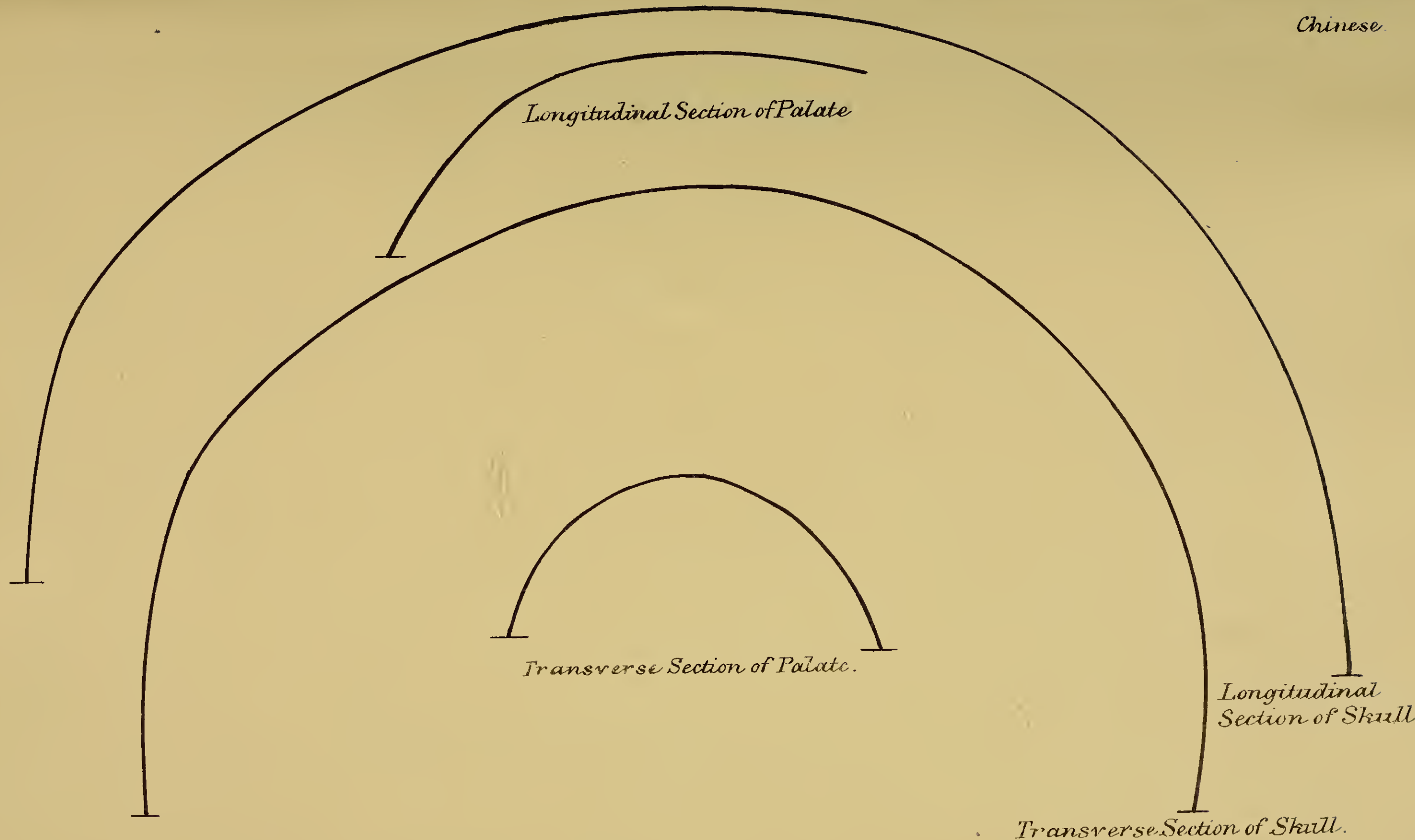
Greek.



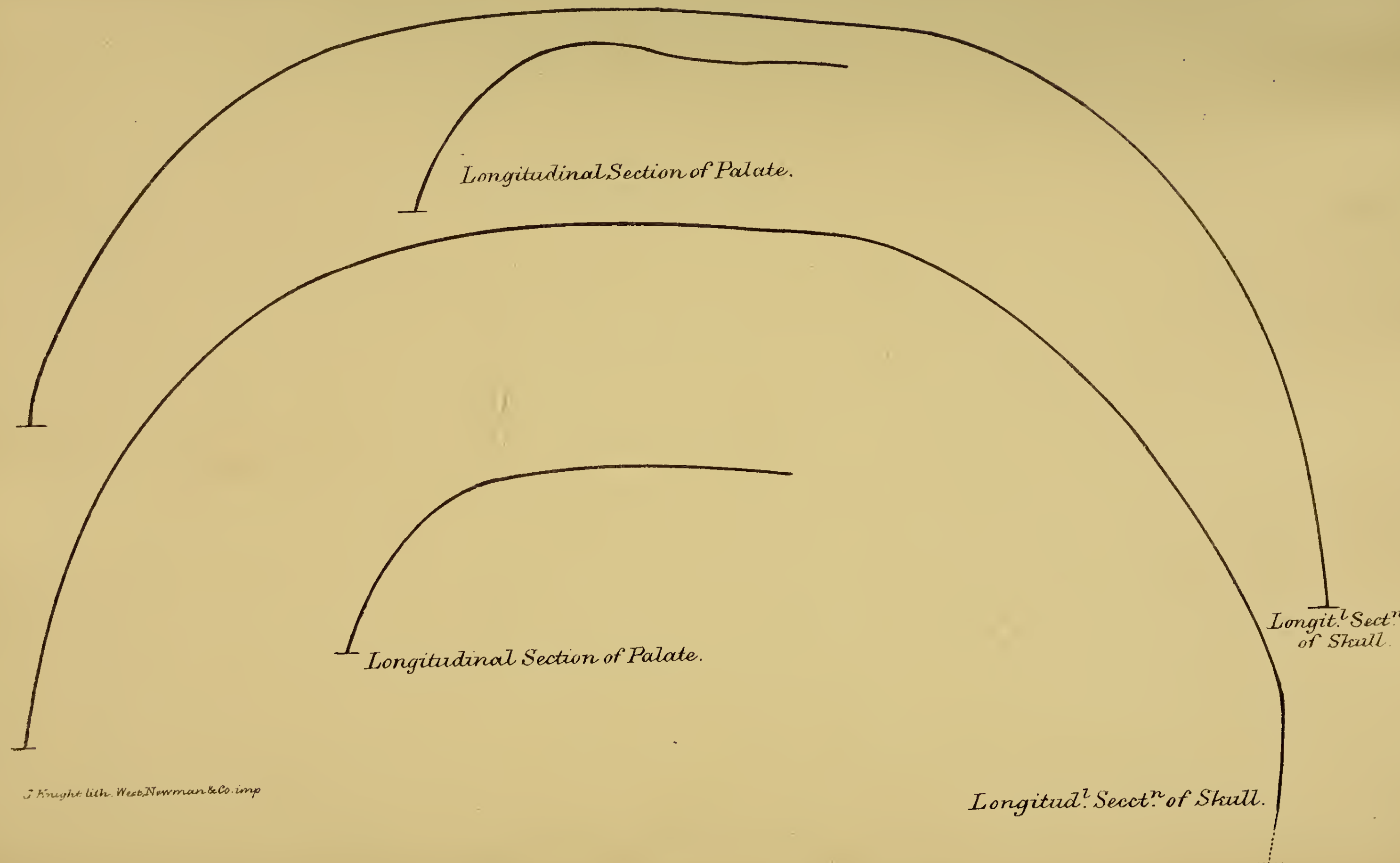
J. Knight lith.

West Newman & Co. imp.

Chinese.



J. Knight lith.
West Newman & Co. imp.

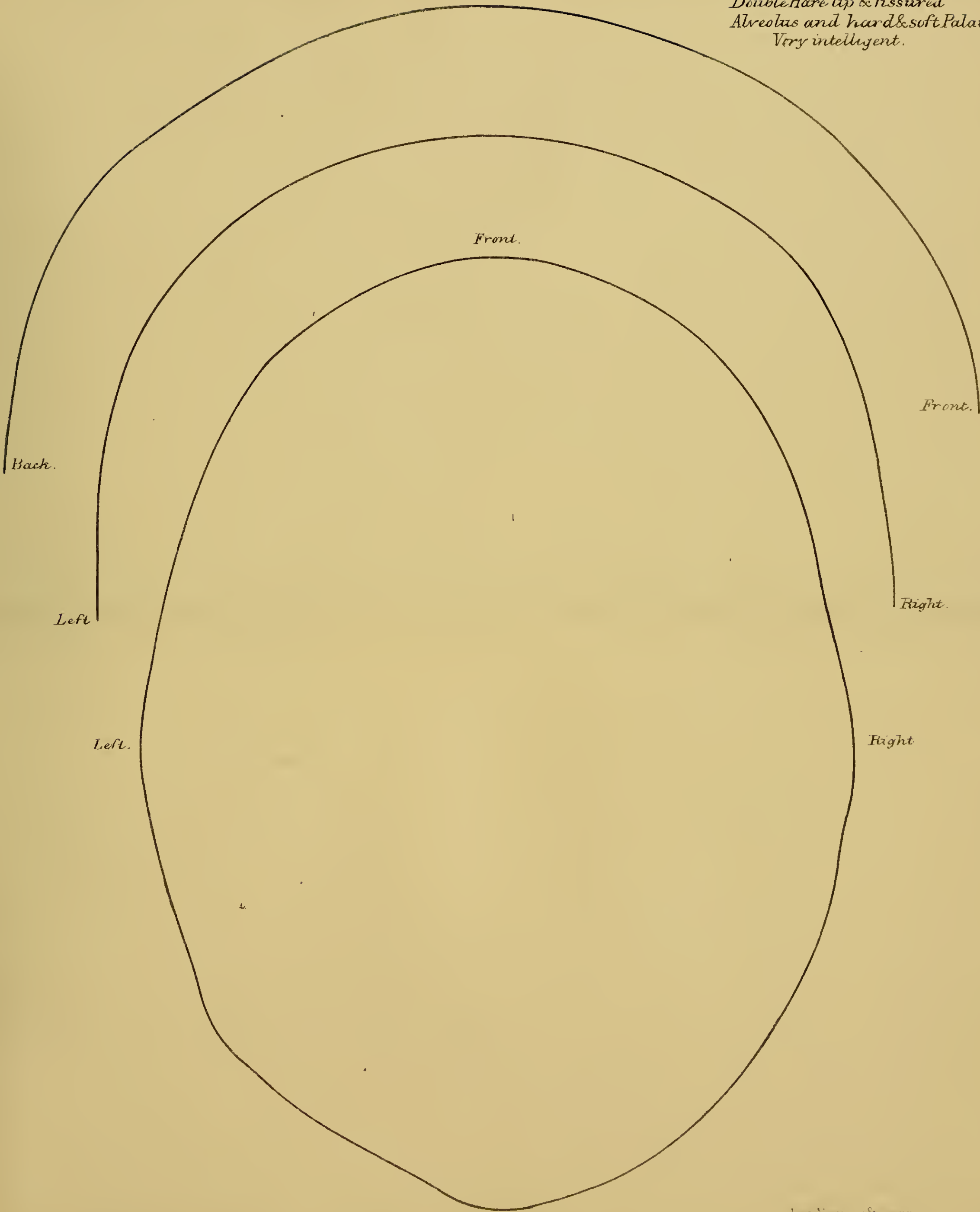


J. Knight lith. West, Newman & Co. imp.

J. Knight lith.

West, Newman & Co. imp.

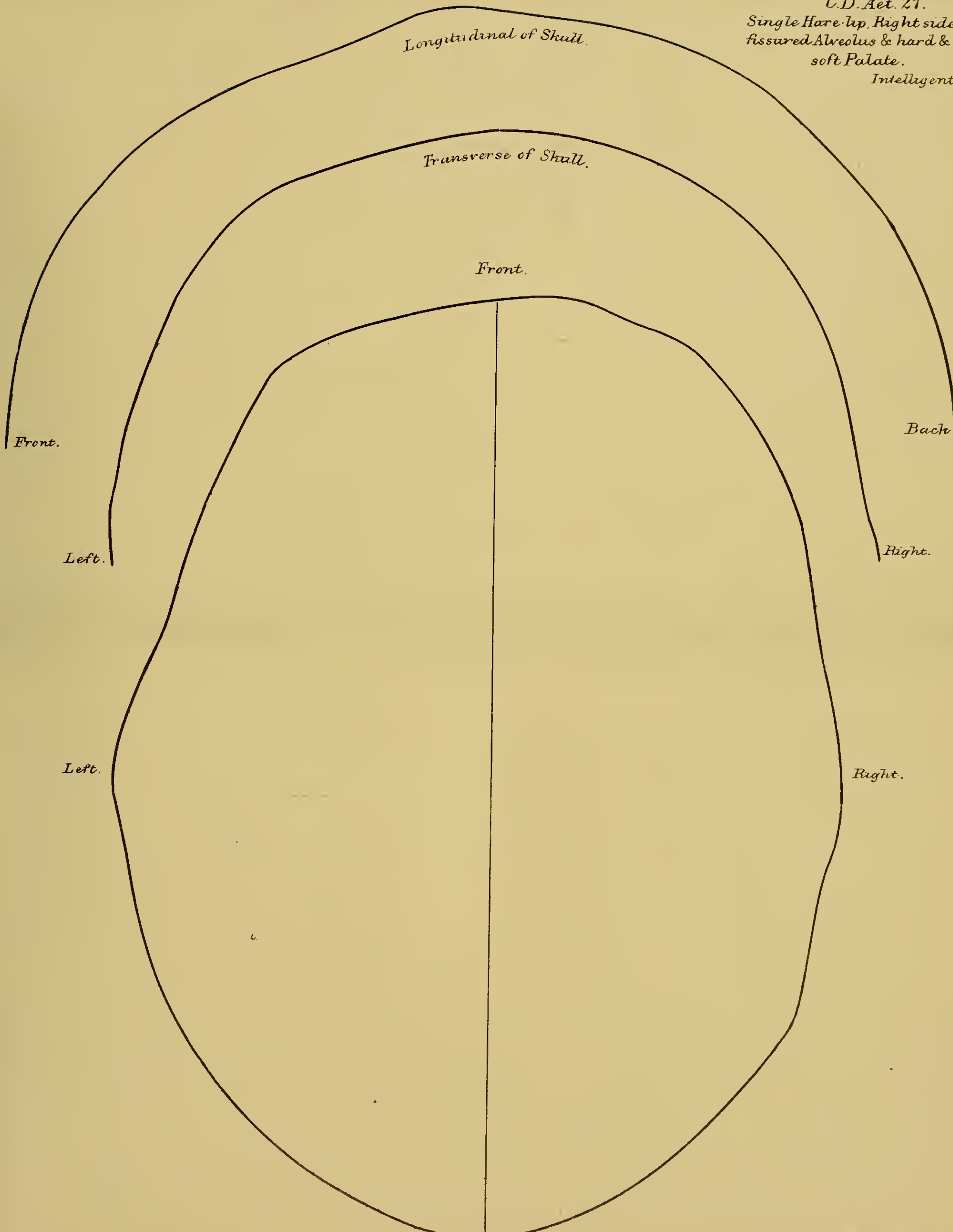
F. S. Aet. 24.
Double Hare lip & fissured Alveolus and hard & soft Palate. Very intelligent.



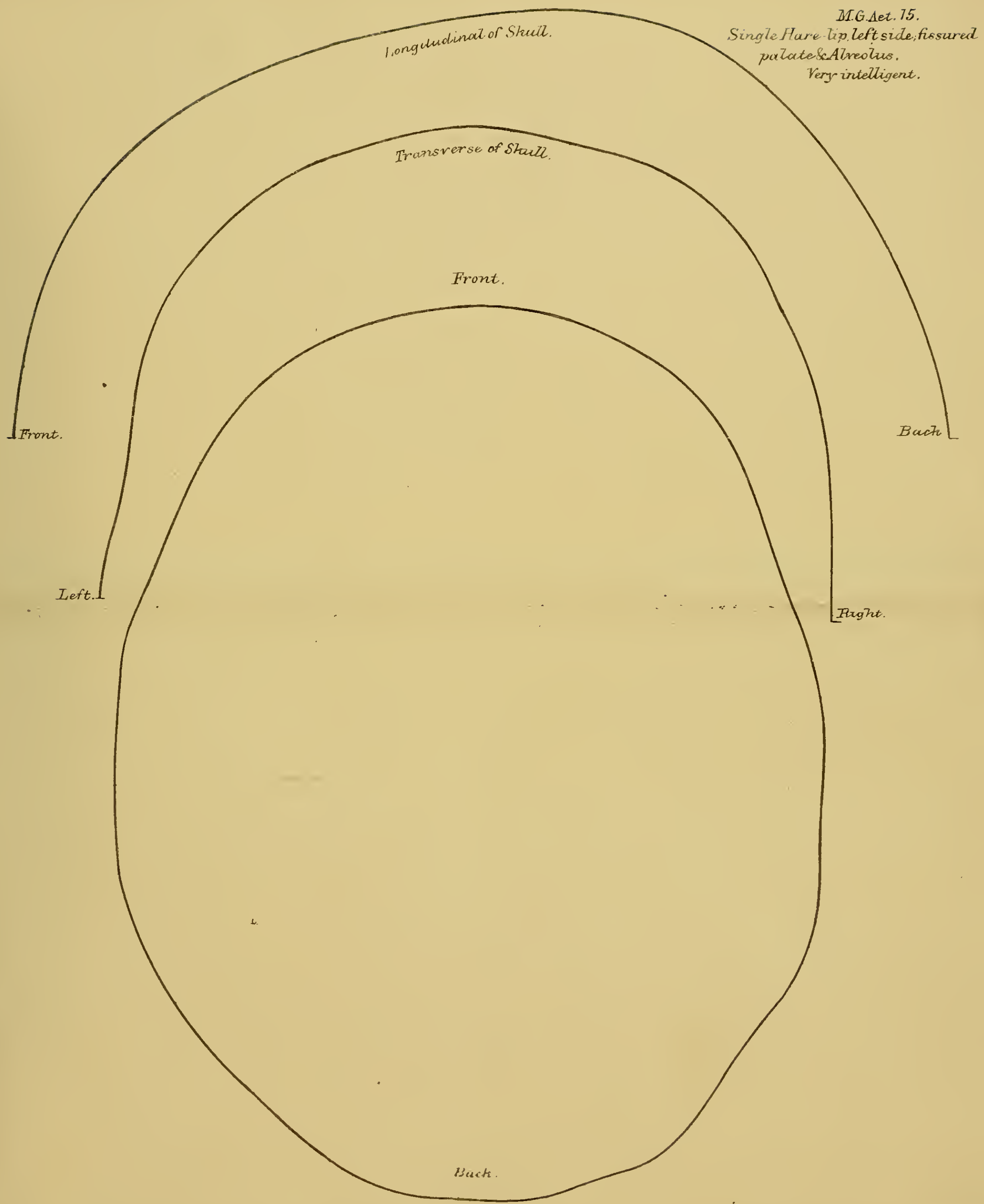
J. Knight lith

Jas. Newman &

C.D. Aet. 21.
Single Hare-lip, Right side,
fissured Alveolus & hard &
soft Palate.
Intelligent.



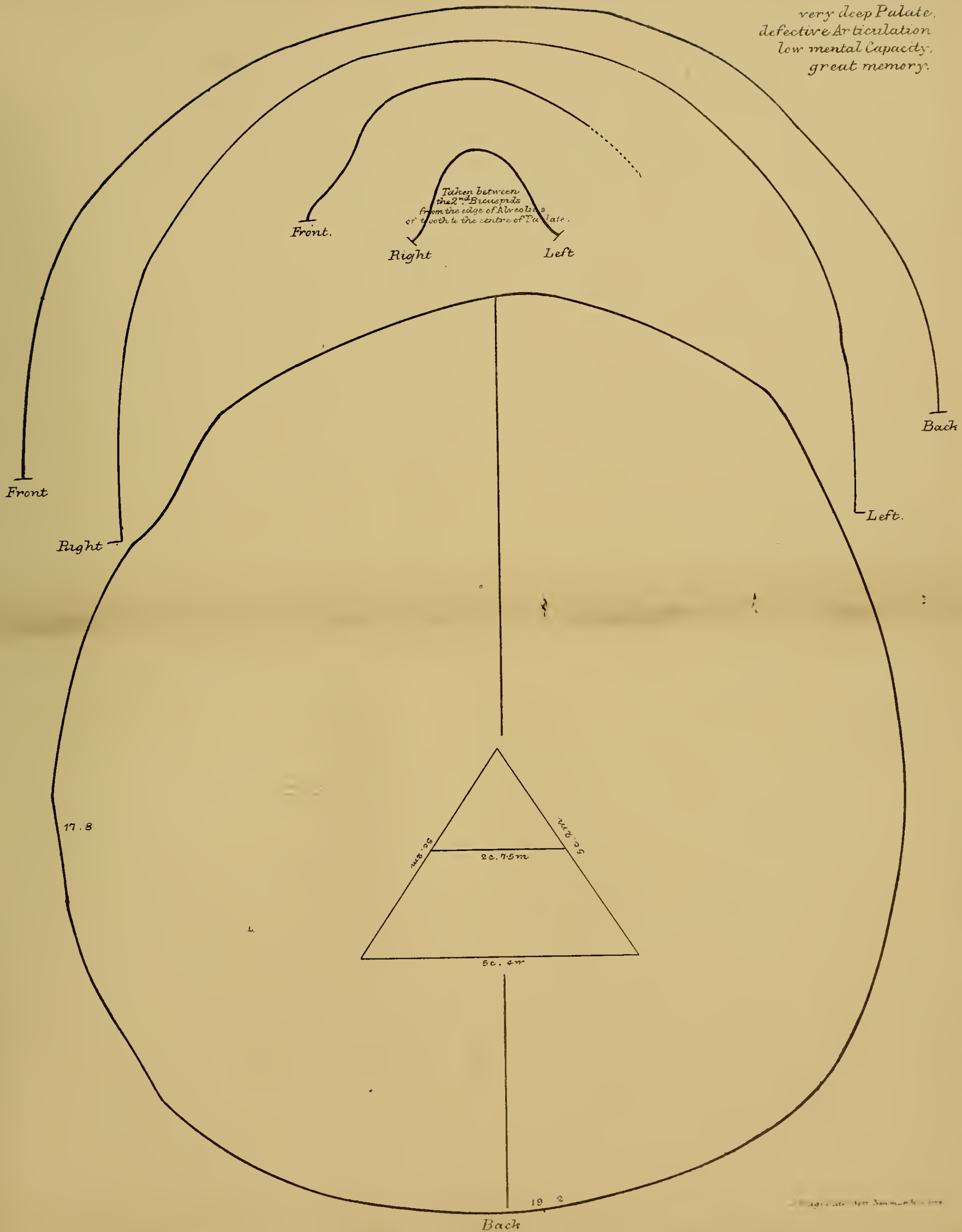
J Knight lith
West Newman & Co imp.



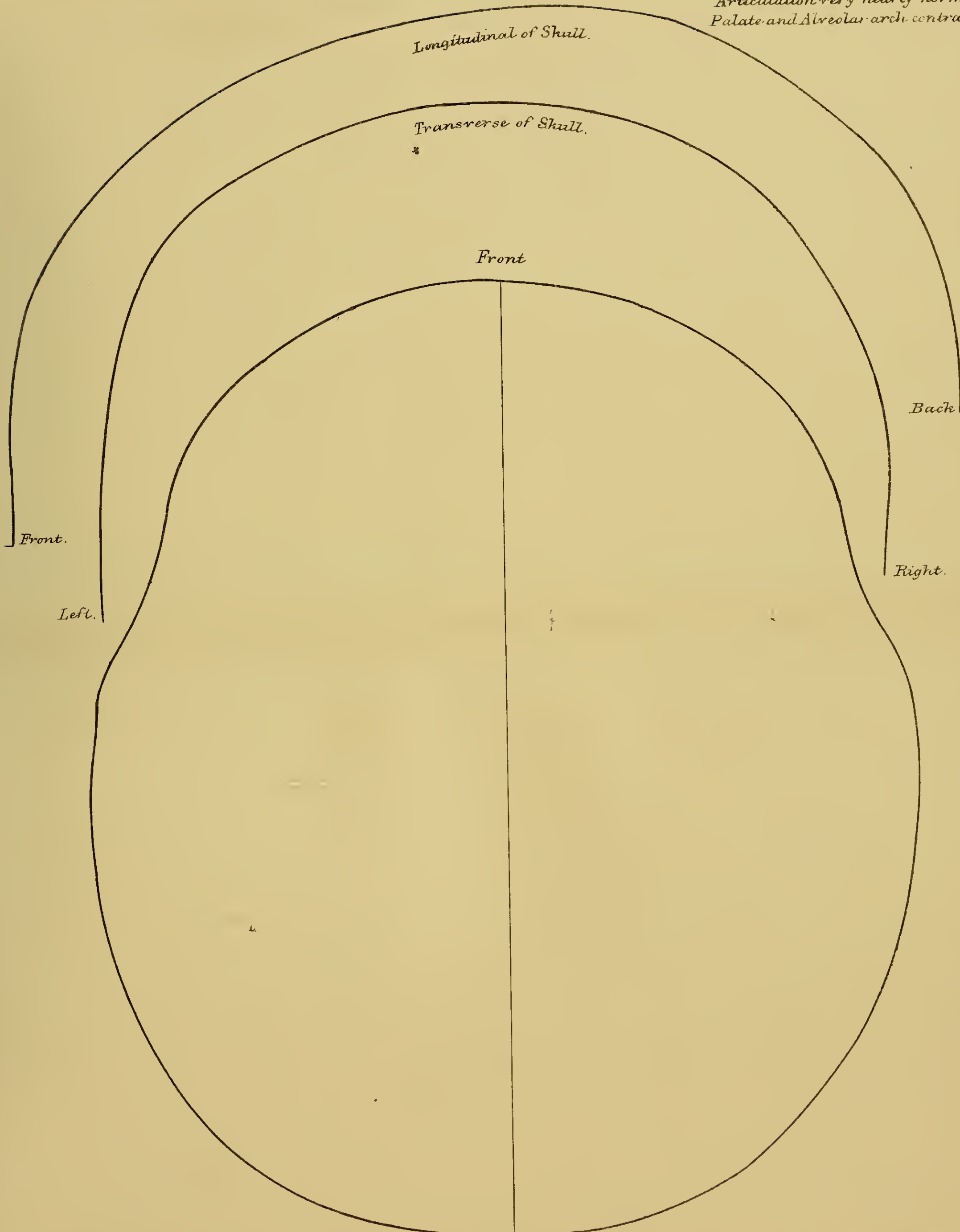
J Knight lith.

West, Newman & Co. imp.

HT Aet. 21.
very deep Palate,
defective Articulation
low mental Capacity,
great memory.



L. W. Aet 37.
Very intelligent & accomplished.
Articulation very nearly normal.
Palate and Alveolar arch contracted.



J Knight lith.

West Newman & Co. imp.

J. C. Aet. 11½.
Intelligence moderate.